The NATIONAL GEOGRAPHIC MAGAZINE

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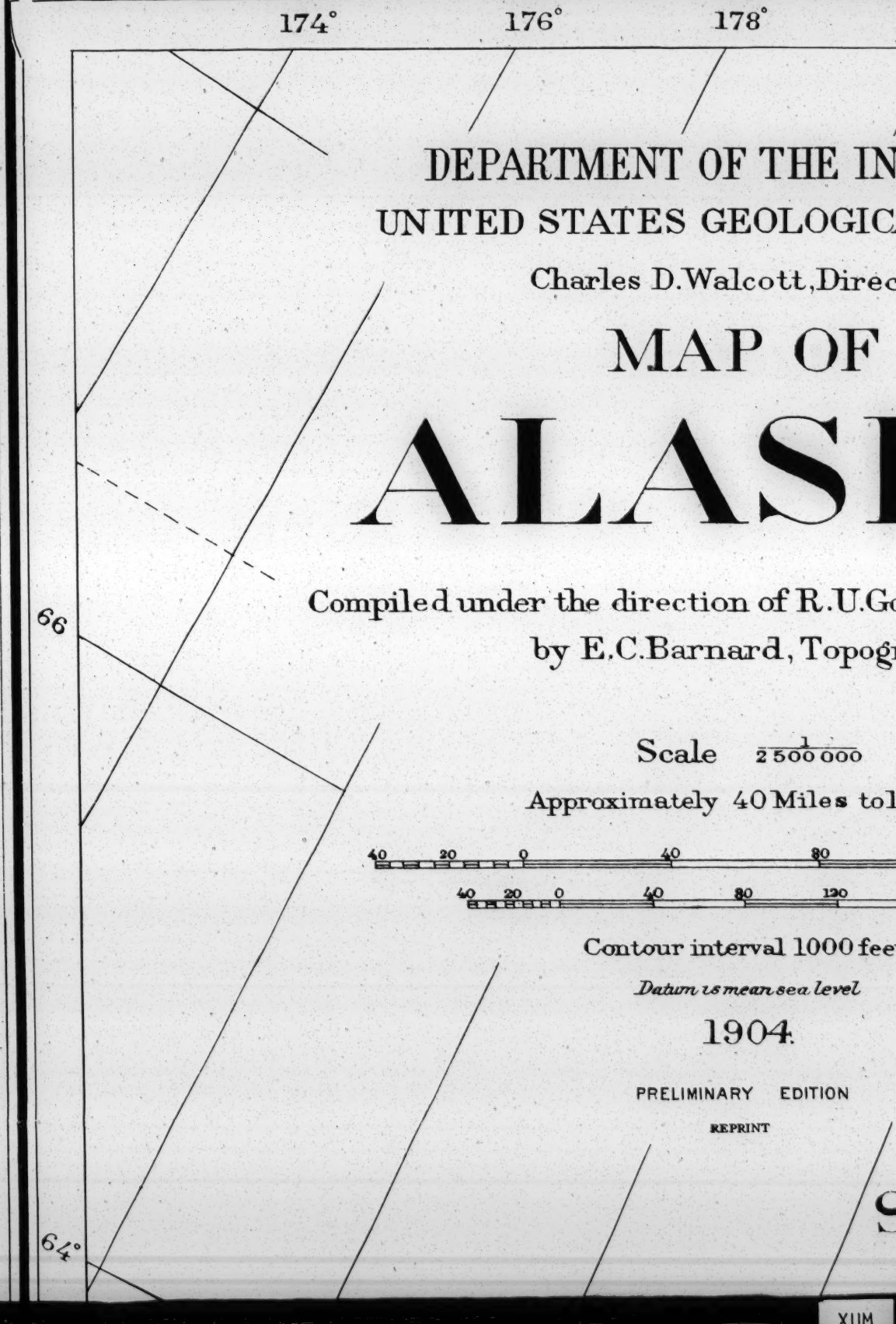
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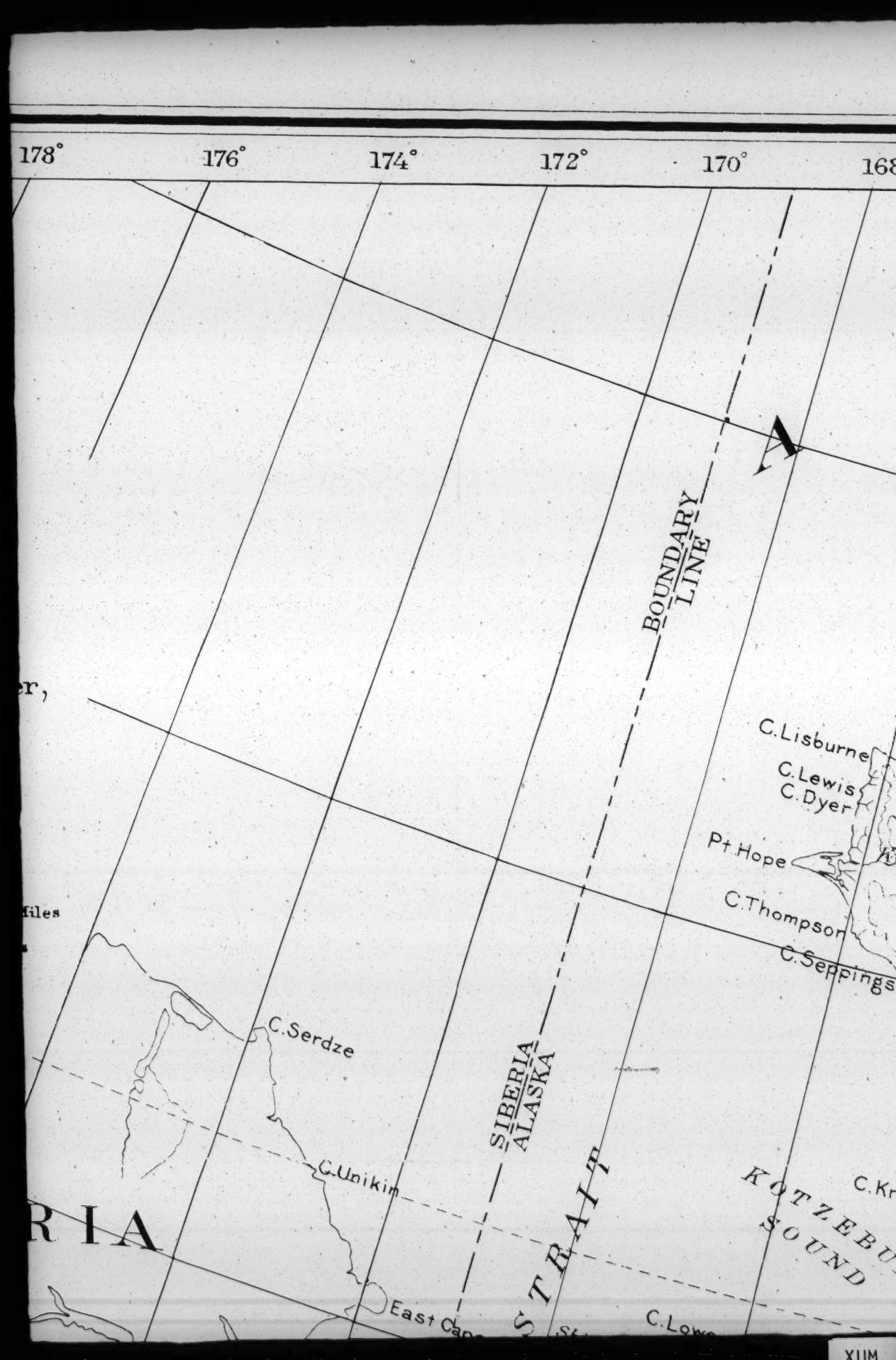
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C. Sabine
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Kukpowruk R.
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Kupuk River
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Wulik R.
NOATAK RIVER
Grand Canyon
Mulgrave Hills
C. Krusenstern
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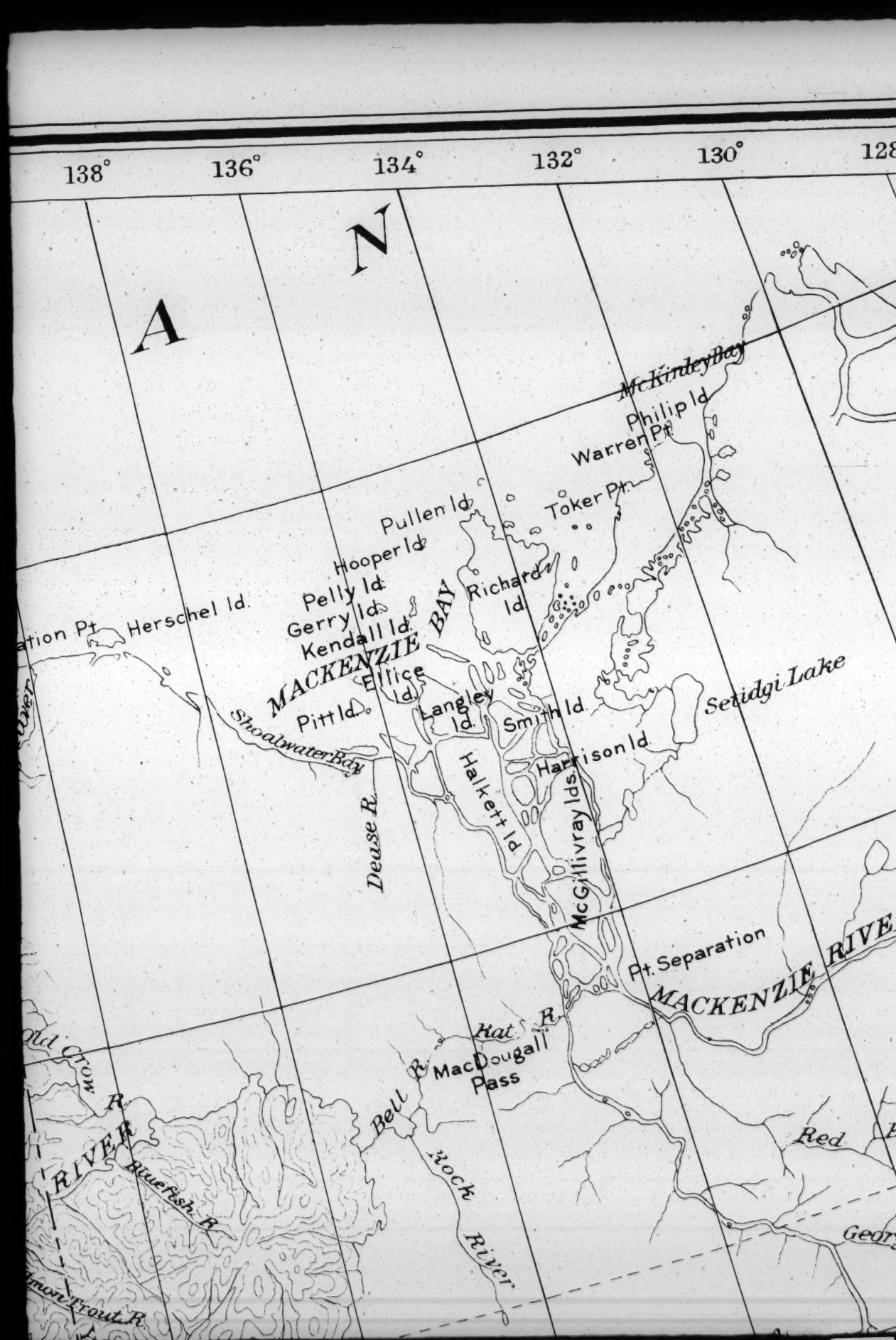
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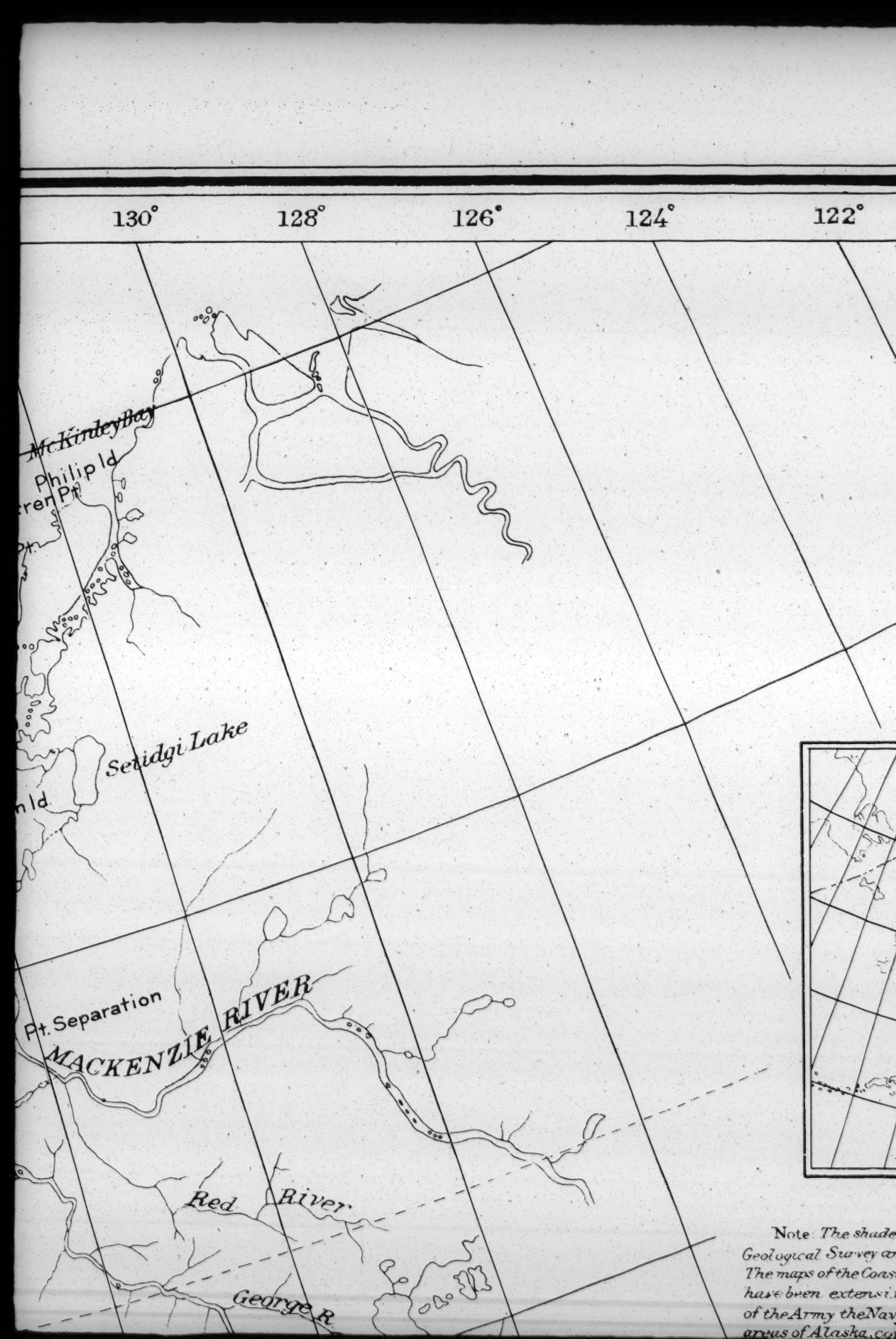
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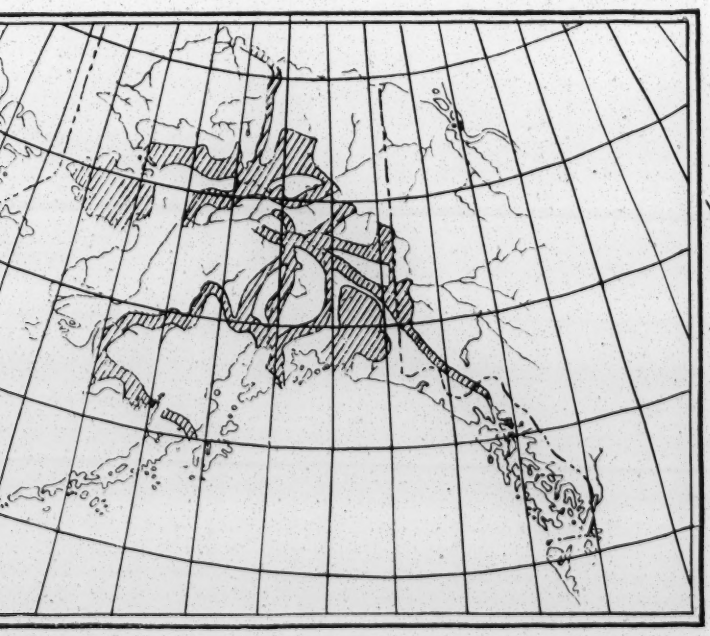

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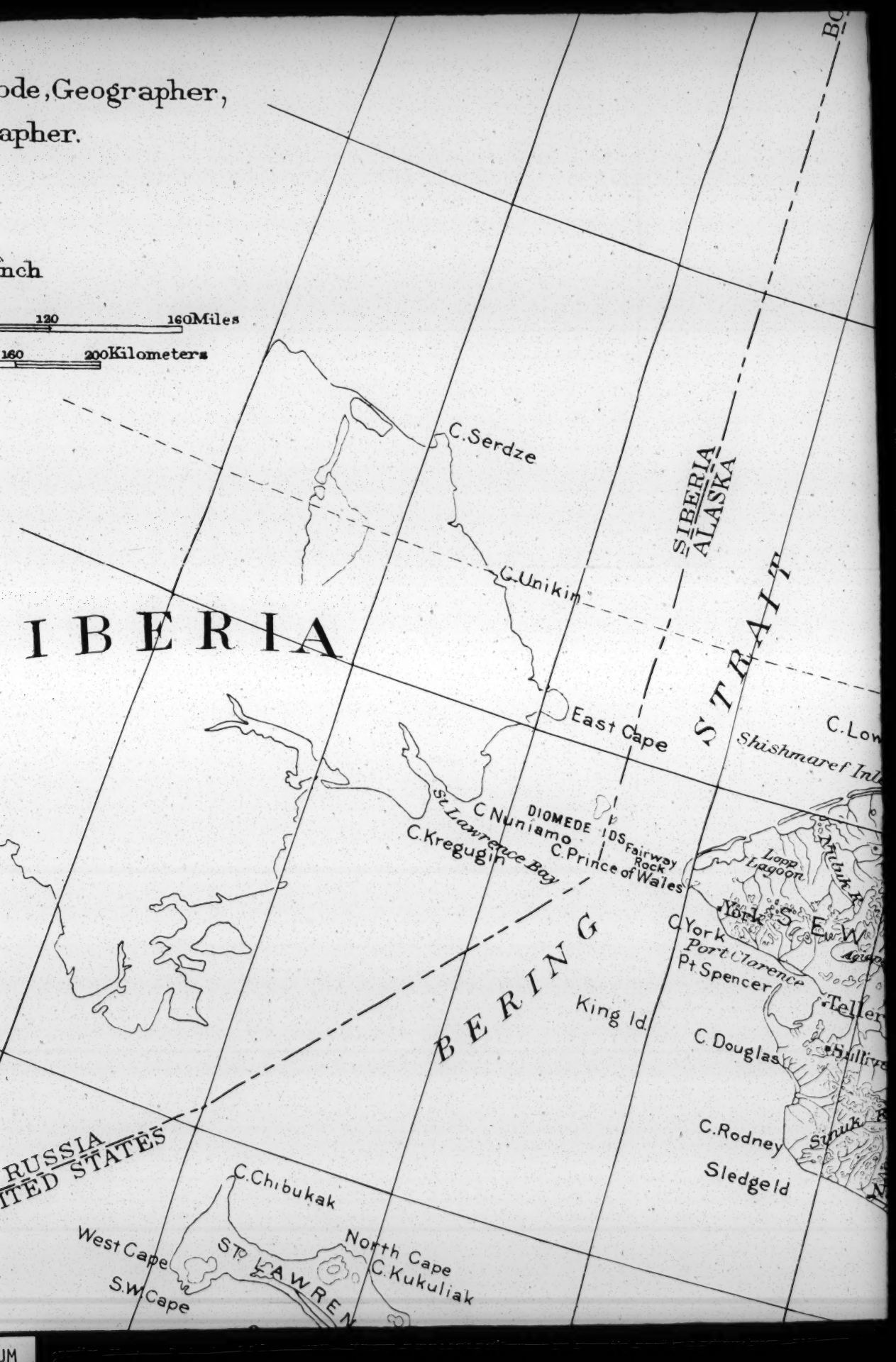

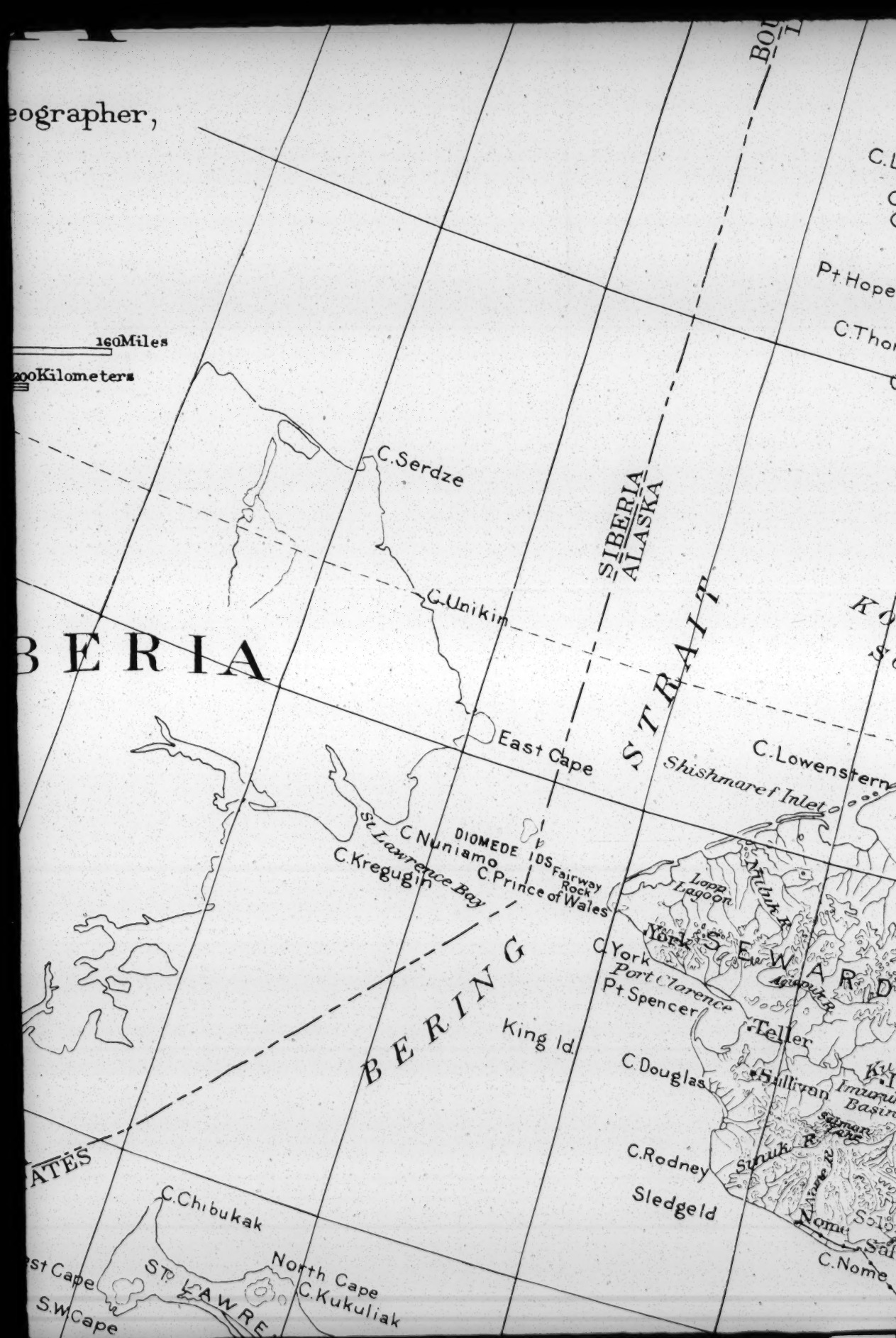

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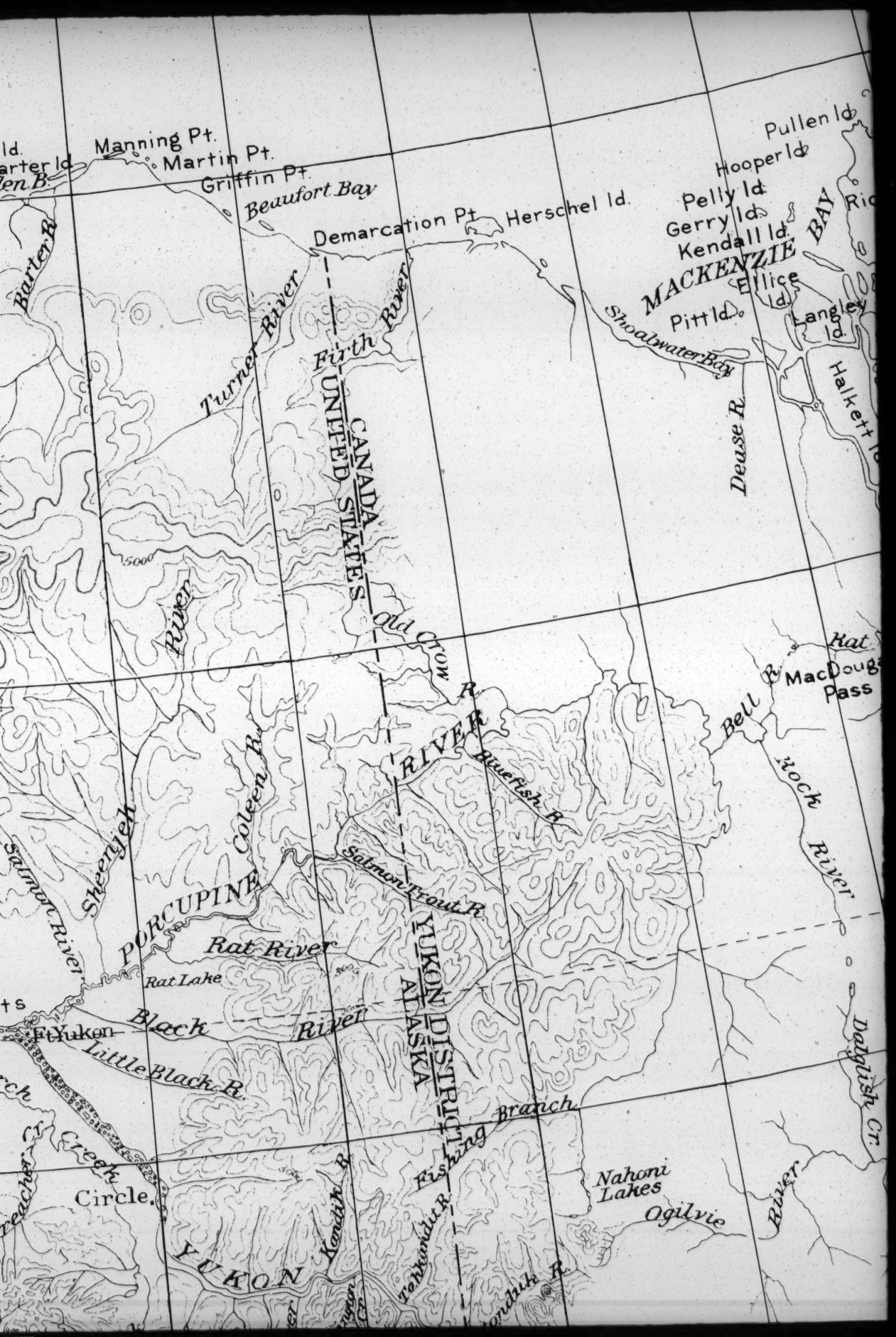

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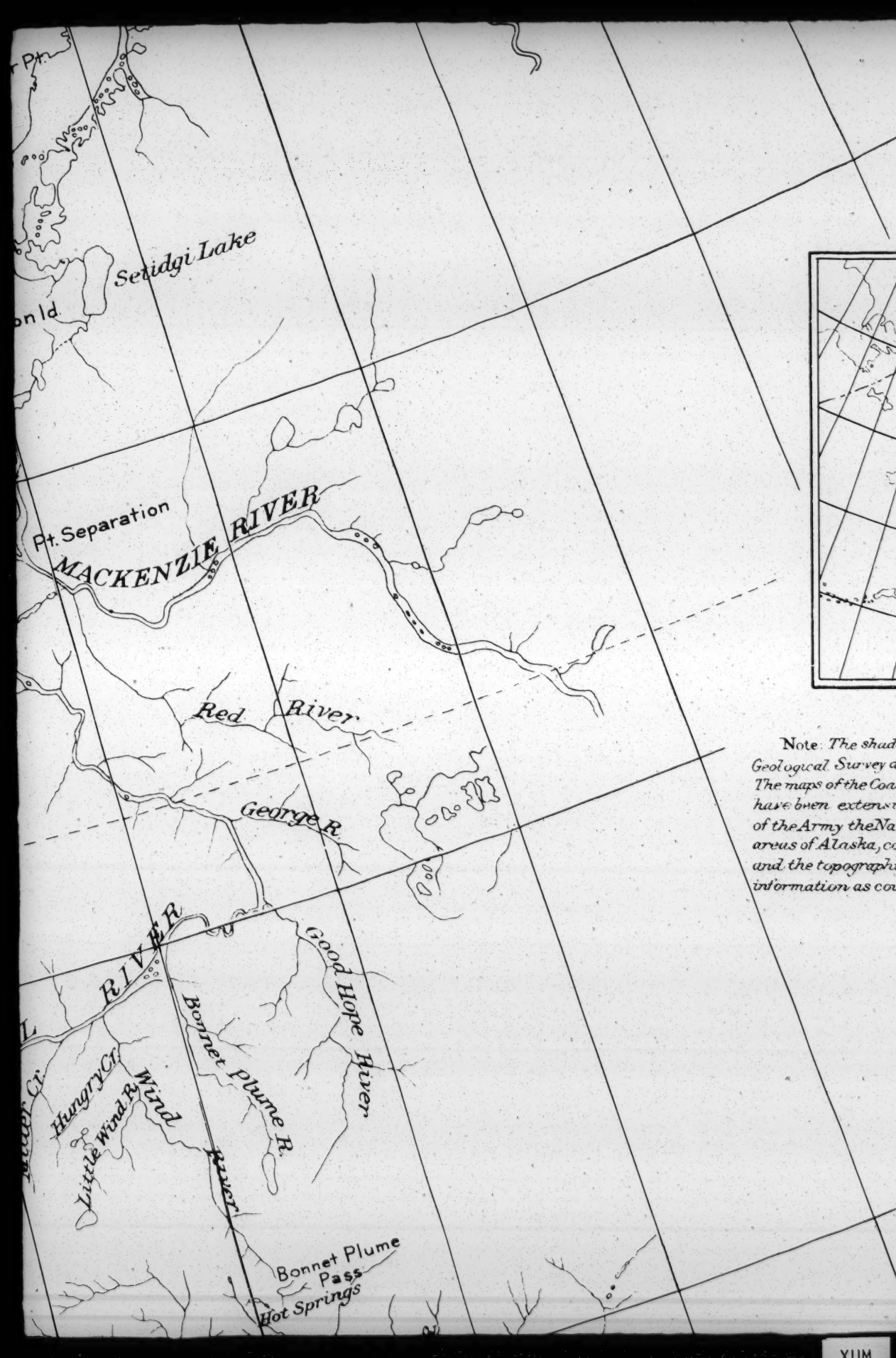
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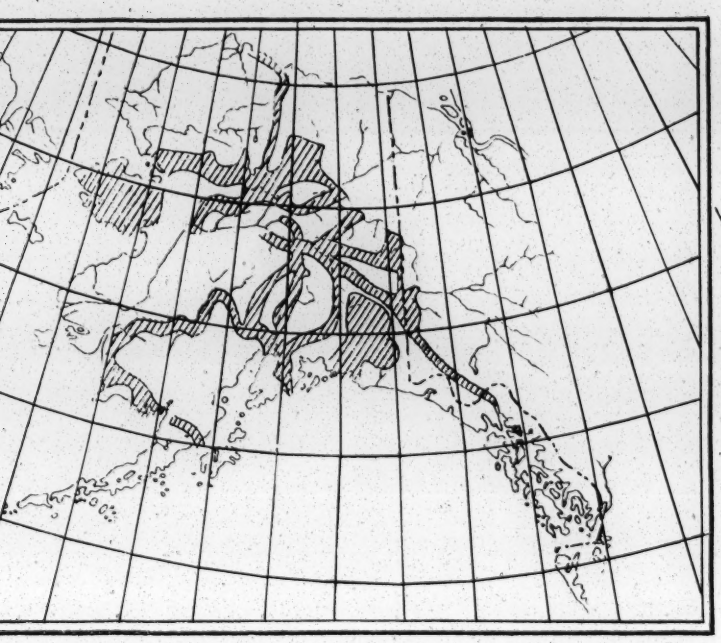

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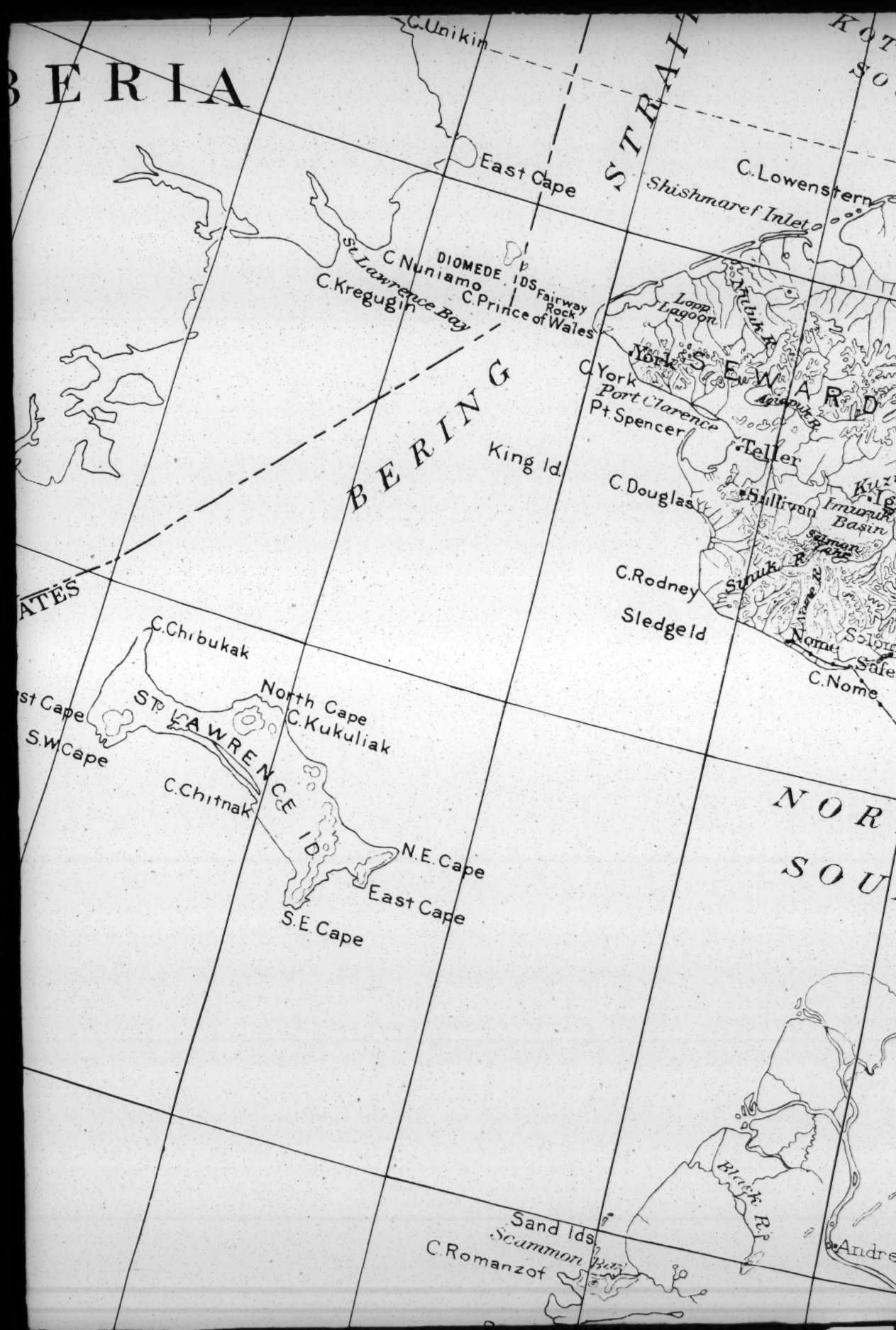

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Anvik
Shageluk Slough
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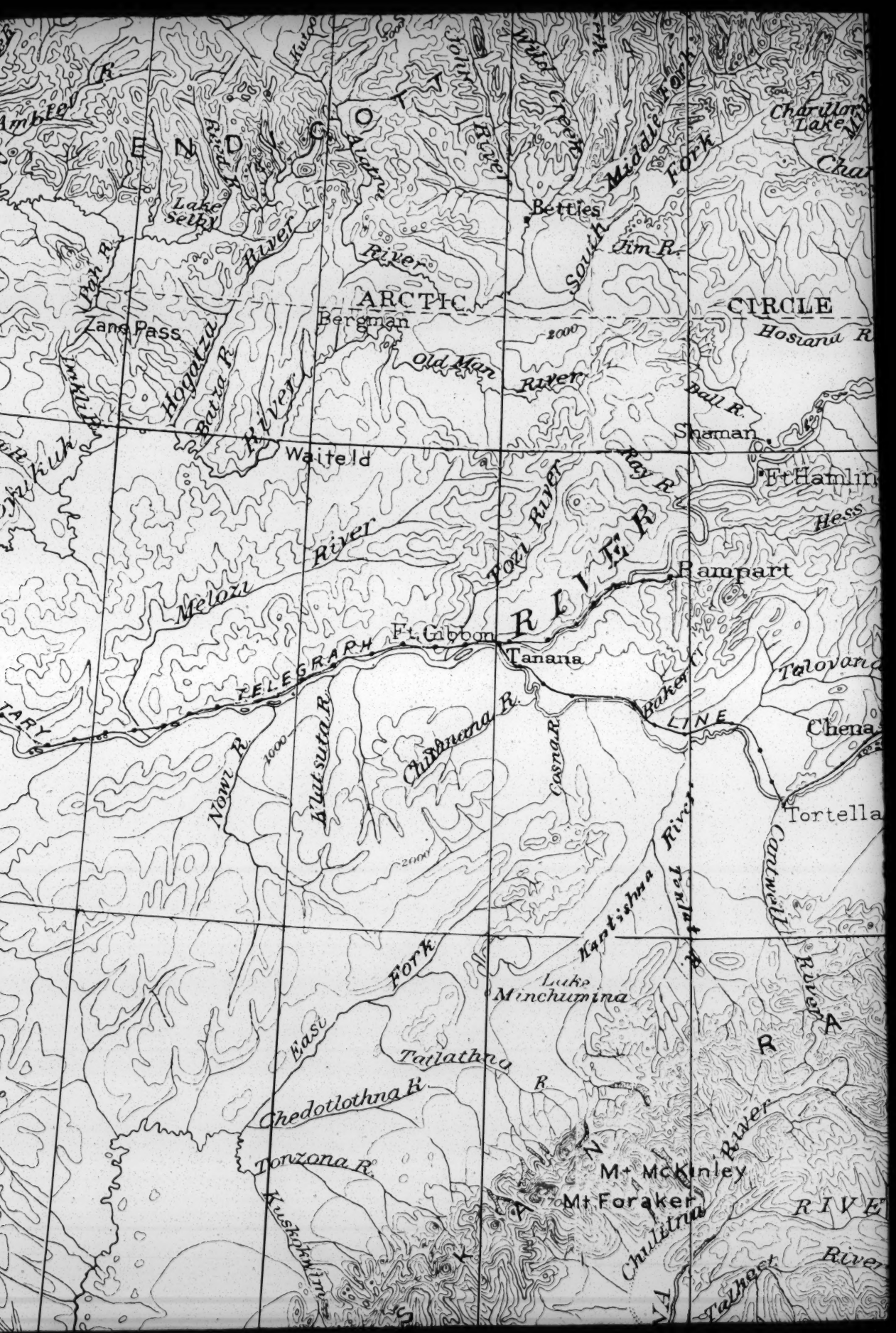
Innoko River
Anvik
Andreafski
Holy Cross
Russian Mission
River



Ambler R.
Lake Selby
Pah R.
Zane Pass
Hogatza River
Batza R.
Dakli R.
Kuyukuk
Alatna River
Bettles
Jim R.
South Middle Fork
Charillon Lake
ARCTIC CIRCLE
Bergman
Old Man River
Hosiana R.
Ball R.
Shaman
Waiteld
Ray R.
Ft Hamlin
Hess
Melozi River
Tozi River
RIVER
Rampart
Ft. Gibbon
Tanana
TELEGRAPH
LINE
Baker Cr.
Chena
Tortella
Nowi R.
Klutsuta R.
Chitanana R.
Cosna R.
Kantishna River
Tonlat R.
Cantwell River
East Fork
Lake Minchumina
Tatlathna R.
Chedotlothna R.
Tonzona R.
Kuskokwim
Mt McKinley
Mt Foraker
Chulitna River
Talkeet River

Ambler R.
Lake Selby
Bettles
South Middle Fork
Jim R.
ARCTIC
CIRCLE
Bergman
Zane Pass
Hogatza R.
Batza R.
Old Man River
Dall R.
Shaman
Huslia R.
Koyukuk
Waiteld
Ray R.
Melozi River
Tozi River
Rampart
Ft. Gibbon
Tanana
MILITARY TELEGRAPH LINE
Baker Cr.
Nowi R.
Klutsuta R.
Chitanana R.
Cosna R.
Kantishna River
Cantwell
Lake Minchumina
East Fork
Tatlathna R.
Chedotlothna R.
Tonzona R.
Mt McKinley
Mt Foraker
Chulitna
Talkeet

Middle
East
Chandlar River
Salmon River
Sheenjek
Coleen
PORCUPINE
Salmon Trout R.
YUKON DISTRICT
ALASKA
Rat River
Rat Lake
Flats
Ft Yukon
Black River
Little Black R.
Yukon
Birch Creek
Beaver Creek
Preacher Cr.
Circle
Fishing Branch
Hamlin
Hess Cr.
Kandik R.
Tahkandit R.
YUKON
Tatonduk
Washington Cr.
Charlie River
North Fork
River
Seventy Mile R.
Star
Eagle
Talovana
Chena R.
Chena
Fairbanks
Salchaket River
Goodpaster R.
Middle Fork
Forty Mile Cr.
Tortella
TANANA
Volkmar R.
BOUNDARY LINE
Silok R.
Delta R.
TELEGRAPH
Lake Mansfield
Mt Hayes
RIVER
Mt Kimball
Ch'sna
Lake Wagner
Mentasta Pass
Gulkana R.
Gakona R.
Chistochina R.
Batzulnetas
Nabesna R.
Gardner Cr.
Scottie Cr.
RIVER
River
Chistochina
MILITARY
Louise Lake
Sanford R.
Mt Sanford
Chisana R.

Sandlar River
Salmon River
Sheenj
PORCUPINE
Salmon Trout R.
Rat River
Rat Lake
YUKON DISTRICT
ALASKA
Flats
Ft Yukon
Black River
Little Black R.
Yukon
Birch Creek
Beaver Creek
Preacher Cr.
Circle
Fishing Branch
Naha Lake
Kandik R.
Tahkandit R.
YUKON
Tatonduk R.
River
North Fork
Charlie River
Washington Cr.
Seventy Mile R.
Star
Eagle
Coal Cr.
Chena R.
Fairbanks
Salchaket River
Goodpaster R.
Middle Fork
Forty Mile
Forty Mile Cr.
TANANA
Volkmar R.
Silok R.
Delta R.
BOUNDARY LINE
Sixty Mile Cr.
Mt Hayes
TELEGRAPH
Lake Mansfield
RIVER
Ladue Cr.
Mt Kimball
Tolsona R.
Chisna
Lake Wagner
Mentasta Pass
Gardner Cr.
Scottie Cr.
Gulkana R.
Gakona R.
Chistochina R.
Batzulnetas
Nabesna R.
Chistochina
MILITARY
Louise Lake
Sanford R.
Mt Sanford
Mt Allen
White River
Mt Drum
Mt Wrangell
Tazlina R.
Copper Center

George R.
River
Dalglish Cr.
PEEL
RIVER
Good Hope River
Bonnet Plume R.
Hungry Cr.
Miller Cr.
Hart R.
Little Wind R.
Wind
River
Ogilvie
Bonnet Plume
Pass
Hot Springs
Mayo Lake
Lansing R.
North Fork
River
Klondike
River
McQuesten
River
Dawson
Janet Lake
STEWART
RIVER
Indian R.
Ogilvie
Lake Cr.
Nogold Cr.
Ethel Lake
Macmillan
River
Scroggie Cr.
RIVER
Selkirk
Pelly
River
Lewes
Little Salmon R.
Klotassin
River
River
Big Salmon
River
Nisling
River

Note: The sh
Geological Surve
The maps of the C
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areas of Alaska
and the topograp
information as

George R.

RIVER

Good Hope River

Bonnet Plume R.

Wind River

Little Wind R.

Hungry Cr.

Miller Cr.

Bonnet Plume Pass

Hot Springs

Mayo Lake

Lansing R.

Janet Lake

RIVER

Nogold Cr.

Ethel Lake

Mucmillan River

Pelly River

Selkirk

Lewes

Little Salmon R.

River

Big Salmon River

Rose

Main Branch

Pelly Lakes

McEvay Lake

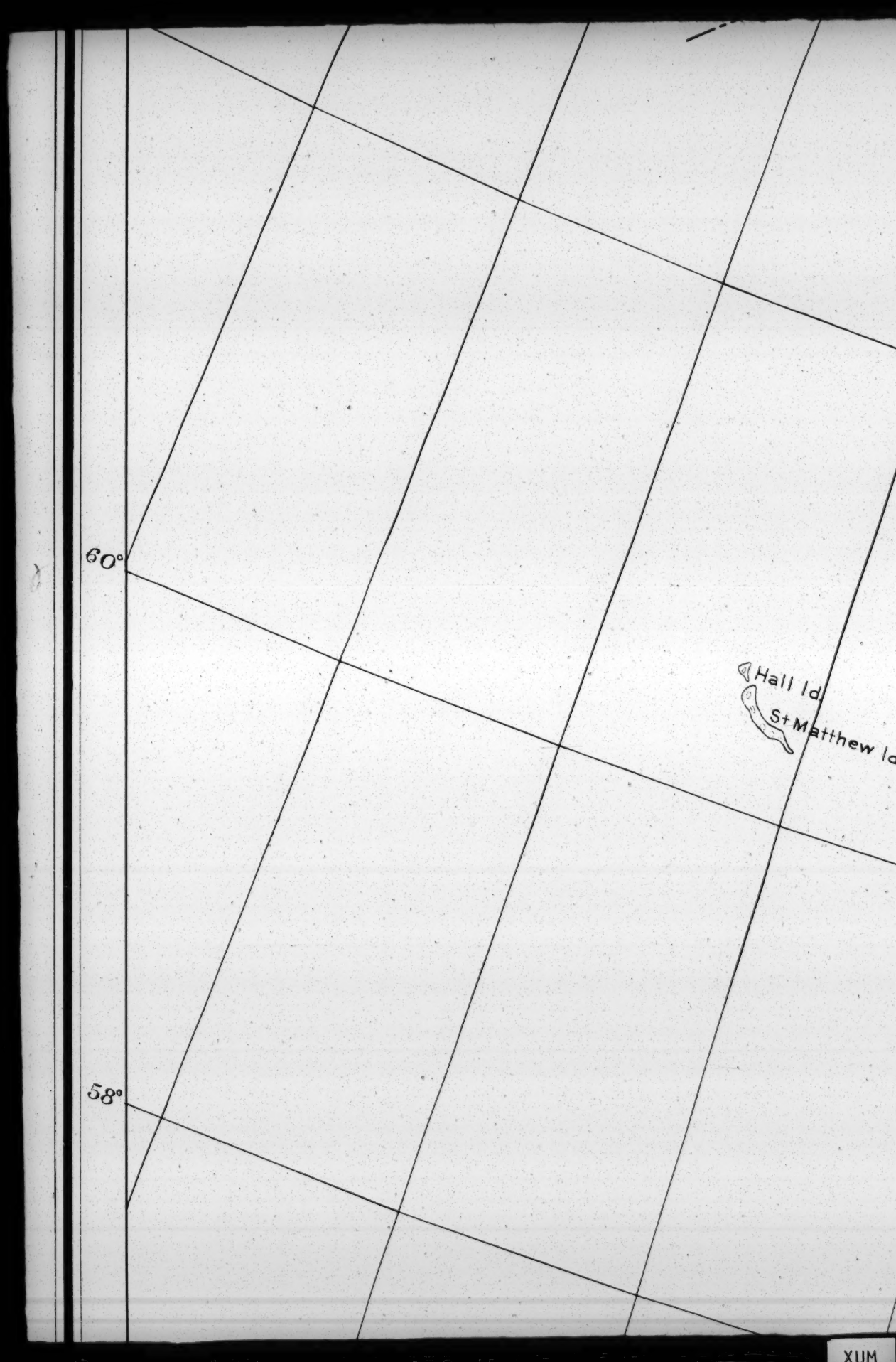
Finlayson Lake

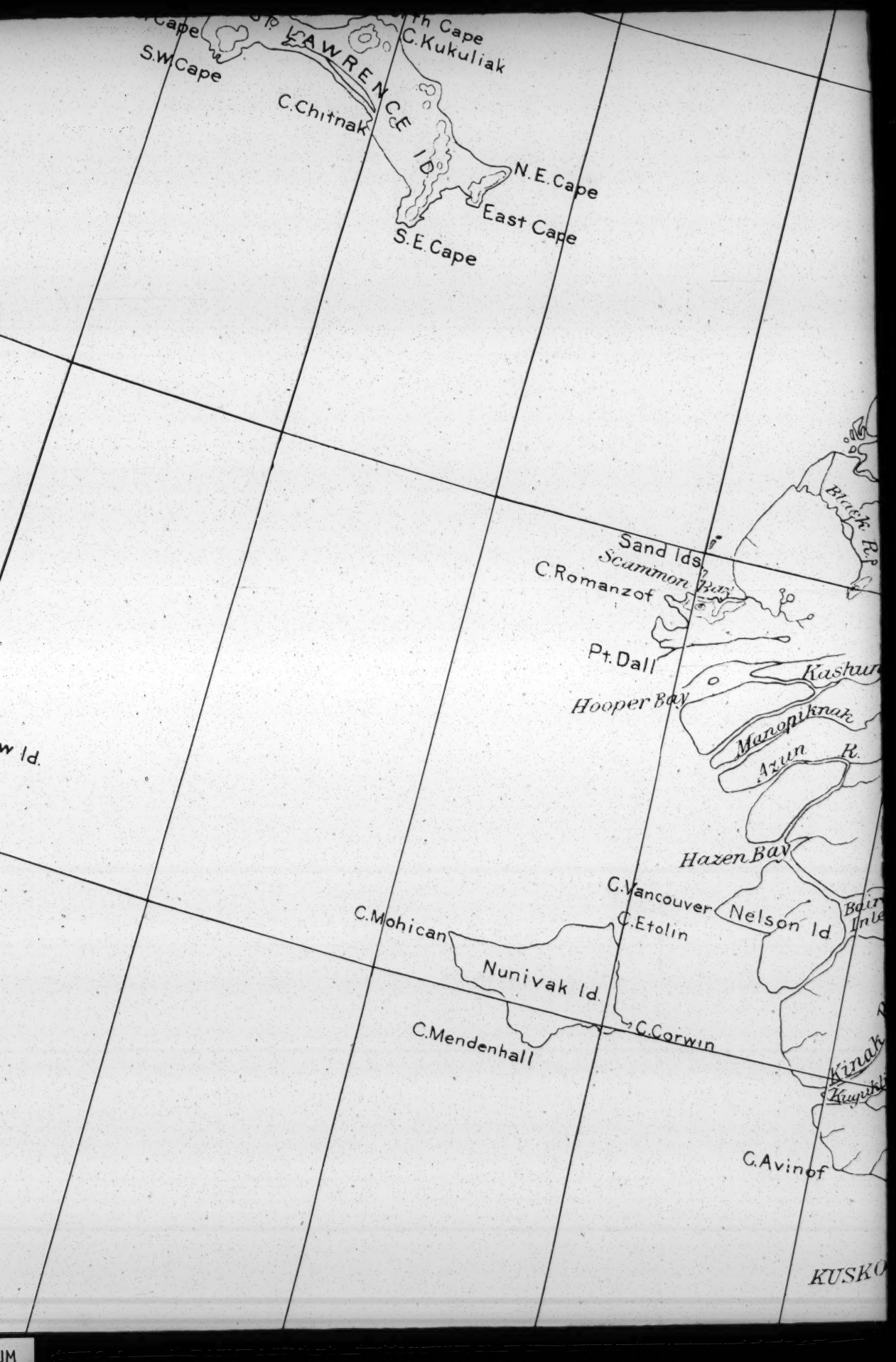
e shaded areas in the above diagram are those which have been mapped by the
rvey and on which the map of Alaska within the coast line is principally based.
he Coast and Geodetic Survey in southeastern Alaska and along the coast
ctensively utilized. Other sources of information have been from the maps
the Navy, the Revenue Marine Service and the British Government. Large
ska, covering by far the greater portion of the map, have not been surveyed,
graphic features shown in these localities are based upon such general
as could be gathered.

64°

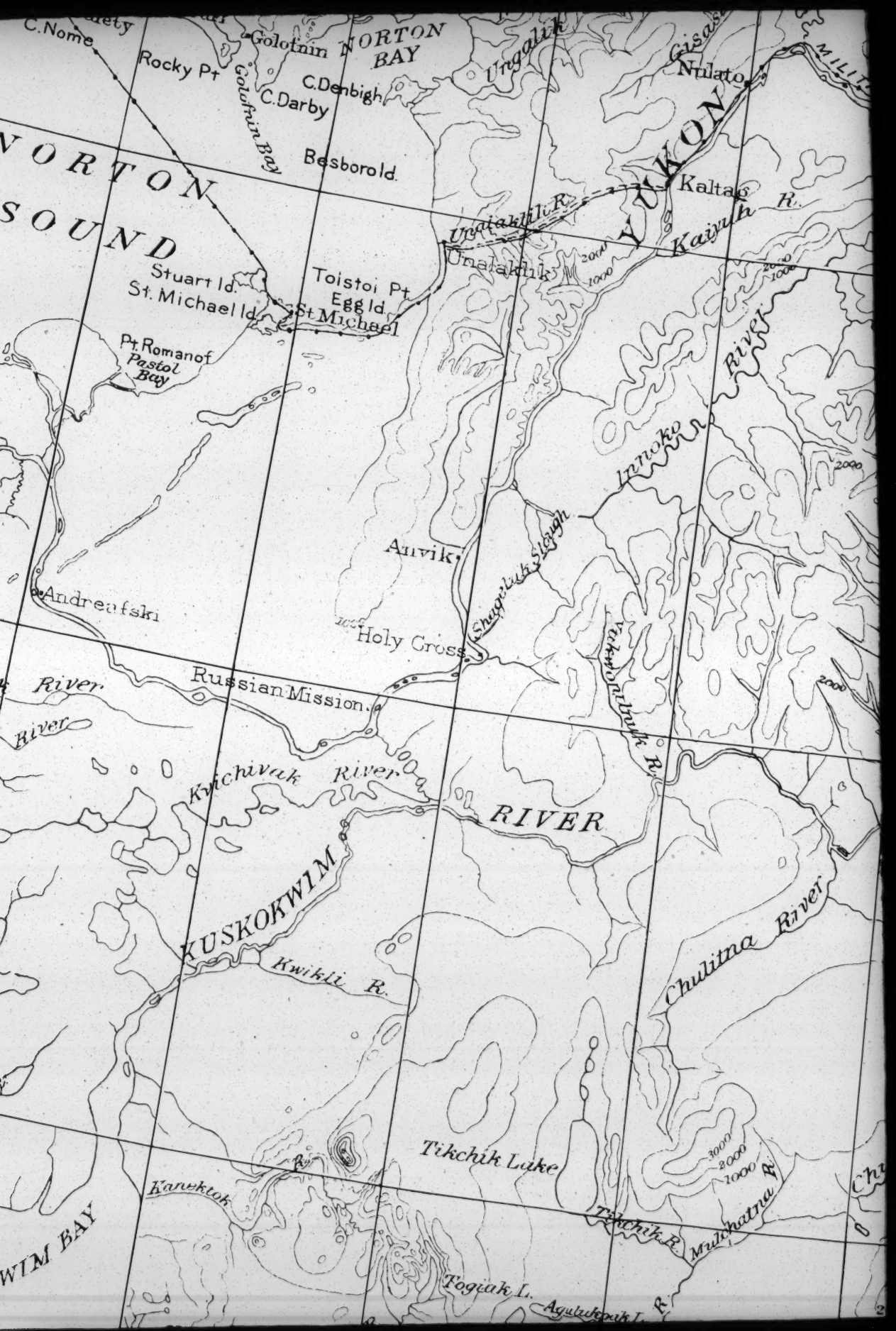
62°

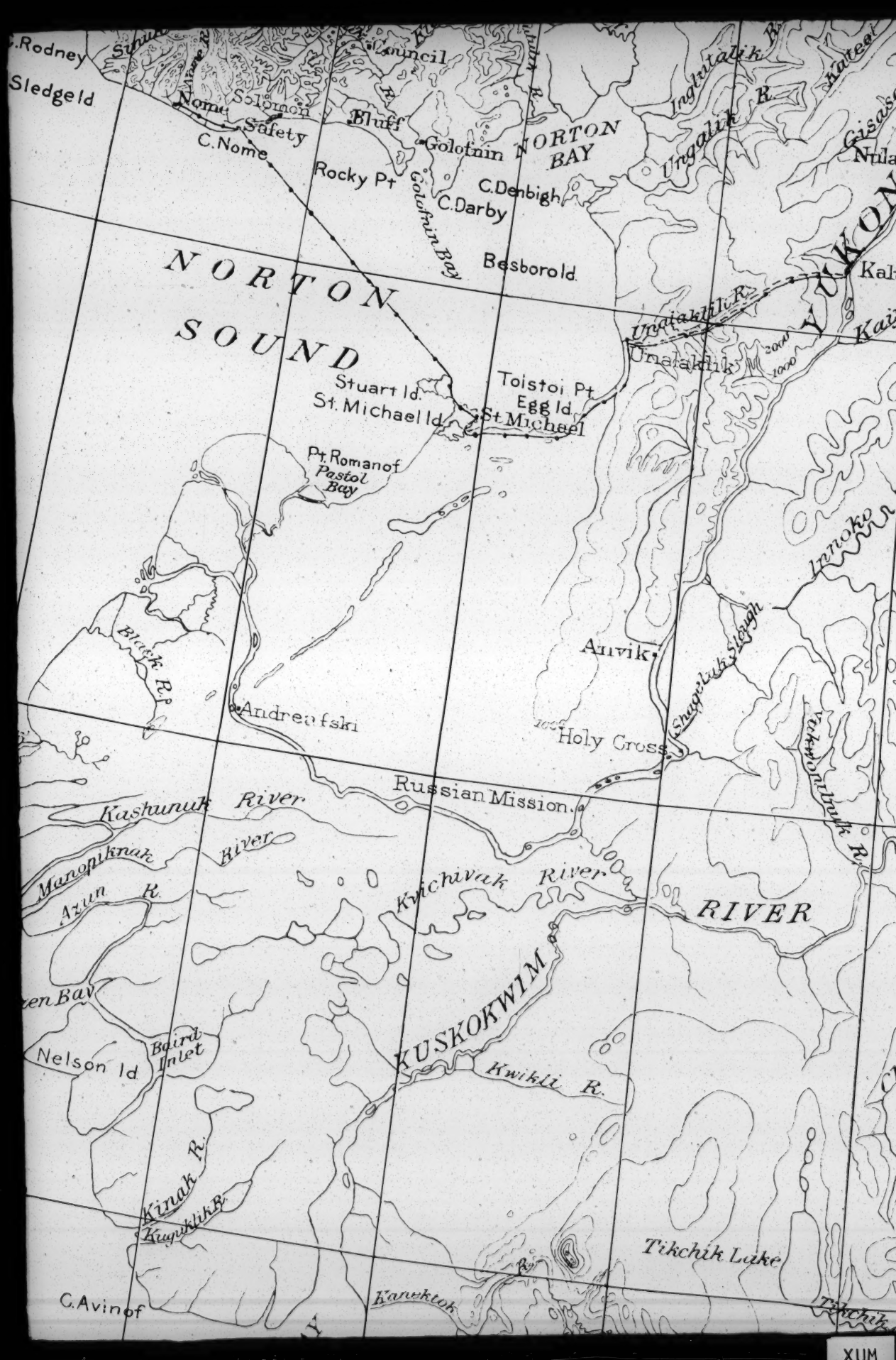
60°


60°
58°
Hall Id.
St Matthew Id

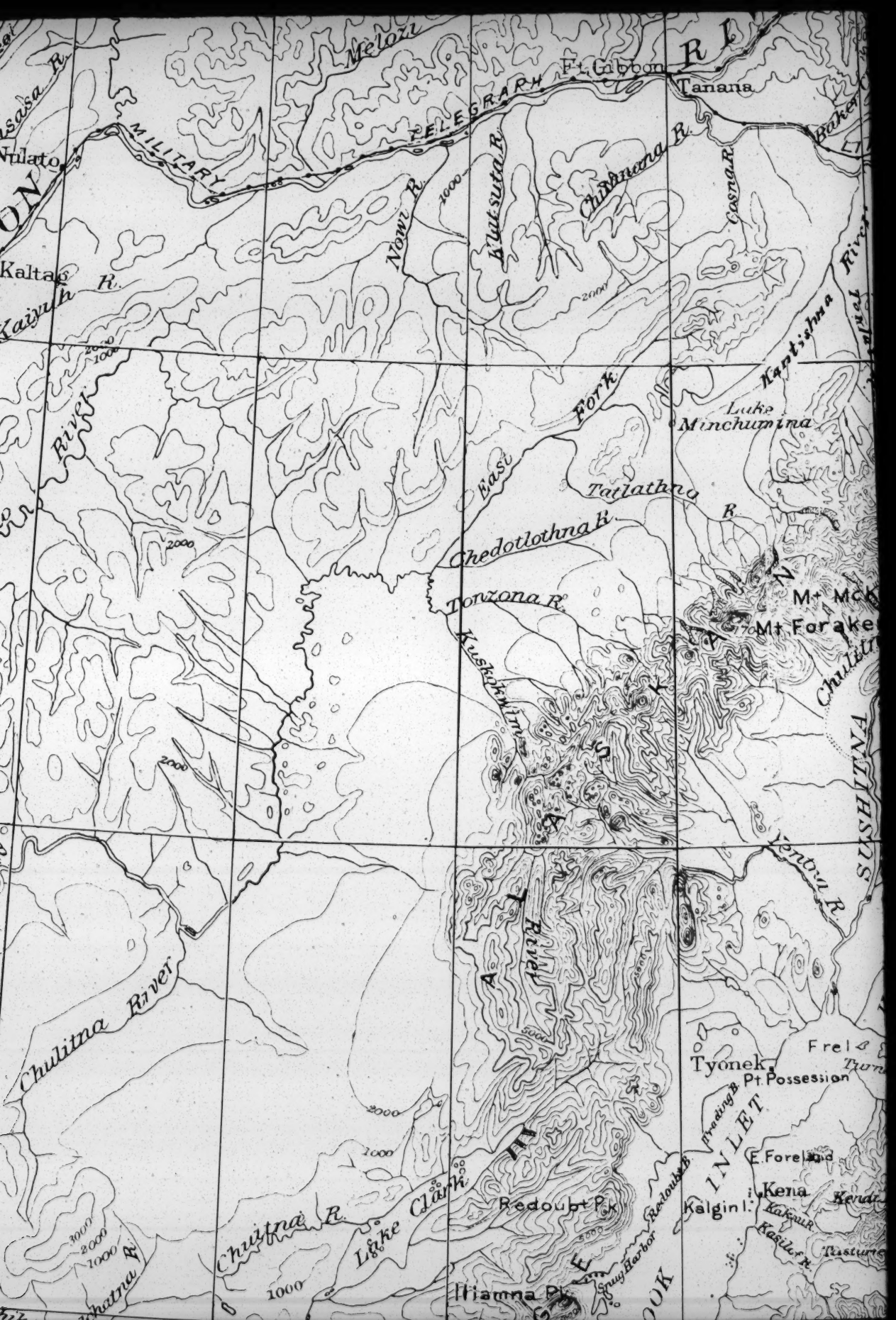

S.W. Cape
C. Chitnak
ST. LAWRENCE ID.
C. Kukuliak
N.E. Cape
East Cape
S.E. Cape
Sand Ids.
Scammon Bay
C. Romanzof
Pt. Dall
Hooper Bay
Kashun
Manopiknak
Azun R.
Hazen Bay
C. Vancouver
Nelson Id.
C. Etolin
C. Mohican
Nunivak Id.
C. Mendenhall
C. Corwin
C. Avinof
KUSKO

S.W. Cape
C. Chitnak
ST. LAWRENCE I.
C. Kukuliak
N.E. Cape
East Cape
S.E. Cape
Sand Ids
Scammon Bay
C. Romanzof
Pt. Dall
Hooper Bay
Kashunuk
Manopiknak
Azun R.
Black R.
Hazen Bay
C. Vancouver
Nelson Id
Baird Inlet
C. Mohican
C. Etolin
Nunivak Id.
C. Mendenhall
C. Corwin
Kinak R.
Kuguklik R.
C. Avinof
KUSKOKWI


C.Nome
Rocky Pt
Golofnin
NORTON BAY
Golofnin Bay
C.Denbigh
C.Darby
Besboro Id.
Ungalik
Nulato
YUKON
Kaltag
Kaiyuh R.
Unalaklik R.
Unalaklik
NORTON SOUND
Stuart Id.
St. Michael Id.
Toistoi Pt.
Egg Id.
St. Michael
Pt. Romanof
Pastol Bay
Innoko River
Anvik
Shageluk Slough
Andreafski
Holy Cross
Russian Mission
River
Kvichivak River
RIVER
KUSKOKWIM
Kwikli R.
Chulitna River
Tikchik Lake
Kanektok
Tikchik R.
Mulchatna R.
WIM BAY
Togiak L.
Agulukpak L.
2000
1000
3000



C.Rodney
Sledge Id
Nome
Solomon
Safety
C.Nome
Council
Bluff
Golofnin
NORTON BAY
Rocky Pt
Golofnin Bay
C.Darby
C.Denbigh
Besboro Id.
Inglutalik R.
Ungalik R.
Kateel
Gisas
Nula
YUKON
NORTON SOUND
Unalaklik R.
Unalaklik
2000
1000
Stuart Id.
St. Michael Id.
Toistoi Pt.
Egg Id.
St. Michael
Pt. Romanof
Pastol Bay
Innoko
Black R.
Anvik
Shageluk Slough
Andreafski
Holy Cross
Vukwonitnuk R.
Russian Mission
Kashunuk River
Manopiknak River
Azun R.
Kvichivak River
RIVER
KUSKOKWIM
Nelson Id
Baird Inlet
Kwikli R.
Kinak R.
Kuguklik R.
Tikchik Lake
C.Avinof
Kanektok
Tikchik



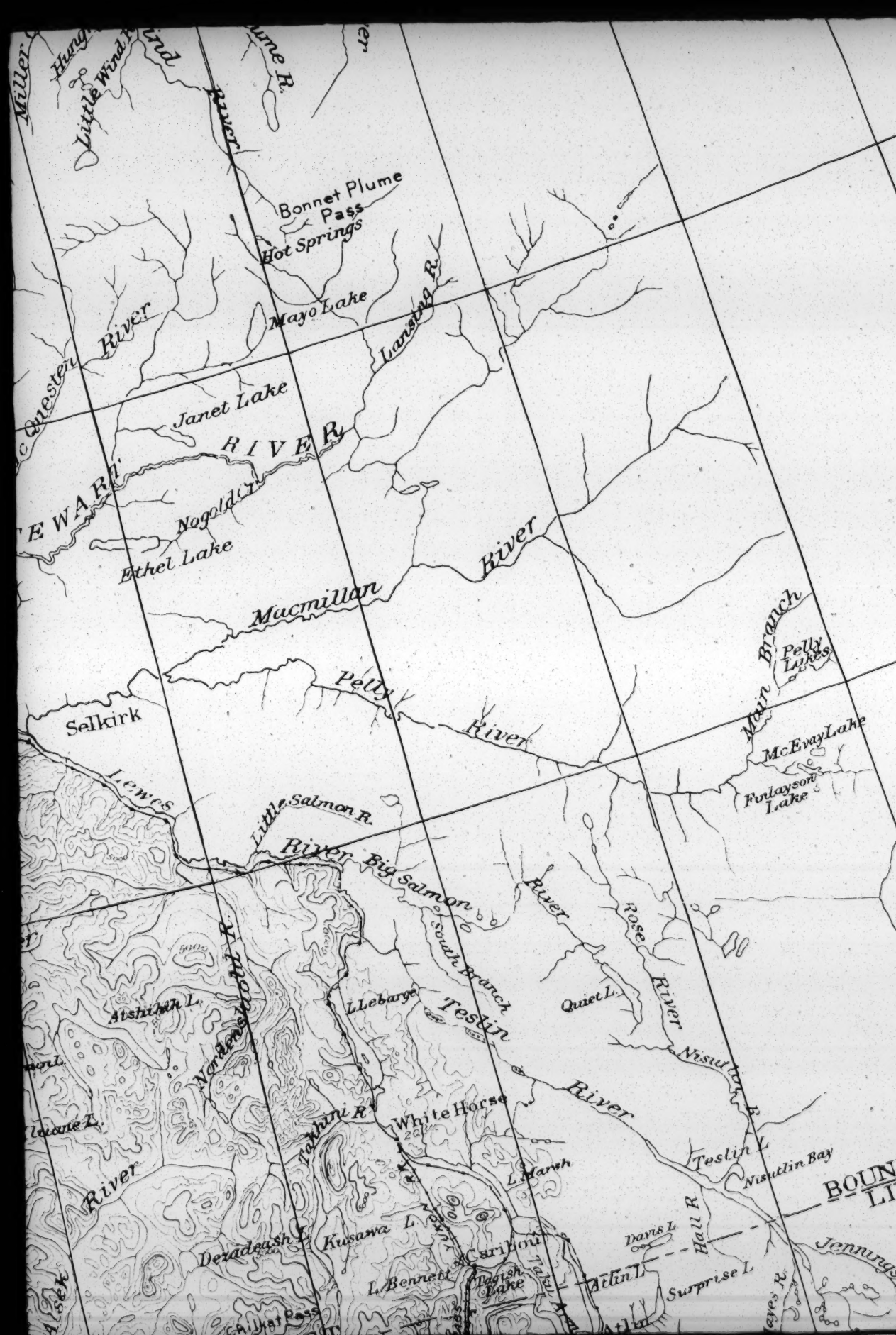
Melozi
Ft. Gibbon
Tanana
TELEGRAPH
MILITARY
Nulato
Kaltag
Kaiyuh R.
Nowi R.
Klatsuta R.
Chitanana R.
Cosna R.
Kantishna River
Lake Minchumina
East Fork
Tatlathna R.
Chedotlothna R.
Tonzona R.
Kuskokwim
Mt McK
Mt Forake
Chulitna
SUSHITNA
Yentna R.
Chulitna River
Tyonek
Pt. Possession
Frel
Trading B.
INLET
E. Foreland
Kena
Kalgin I.
Redoubt B.
Redoubt Pk.
Lake Clark
Chuitna R.
Iliamna Pk.
Snug Harbor

Inglutalik R.
Ungalik R.
Kateel R.
Gisasa R.
Nulato
YUKON
MILITARY
TELEGRAPH
Melozi
River
Ft. Gibbo
Nowi R.
Klatsuta R.
Kaltag
Kaiyuh R.
Unalaklik R.
Unalaklik
2000
1000
Innoko
River
East
Fork
Tatlat
Chedotlothna R.
Tonzona R.
Kuskokwim
Shagaluk Slough
Vakwontluk R.
RIVER
Chulitna River
Chuitna R.
Lake Clark
Redoubt Pk.
Tikchik Lake
3000
5000

Rampart
Tanana
Baker Cr.
Talovana
LINE
Chena
Chena R.
Fairbanks
North Fork
Salchaket River
Goodpaster R.
Tortella
TANANA
Volkmar
Cosna R.
Kantishna River
Cantwell River
Silok R.
Delta R.
Lake Minchumina
Mt Hayes
R A N G E
Mt McKinley
Mt Foraker
Chulitna River
RIVER
Talkeet River
SUSHITNA
Gulkana R.
Gakona R.
MILITARY
Louise Lake
Sanford R.
Mt Drum
Tazlina R.
Copper Center
COPPER
Yentna R.
Matanuska R.
CHUGACH
MOUNTAINS
Knik Arm
Knik R.
Valdes Glacier
Valdes
Tyonek
Pt. Possession
Frel
Pt Campbell
Turnagain Bay
Hope
Sunrise
Port Wells
Port Valdes
Ellamar
Fidalgo Bay
Naked I.
Port Nellie Juan
PRINCE WILLIAM
SOUND
Orca
INLET
E. Foreland
Kena
Kalgin I.
Kenai I.
Kasilof R.
Tustumena I.
Knight Id.
Green Id.
Chenega
Hinchinbrook Id
C. Hinchinbrook

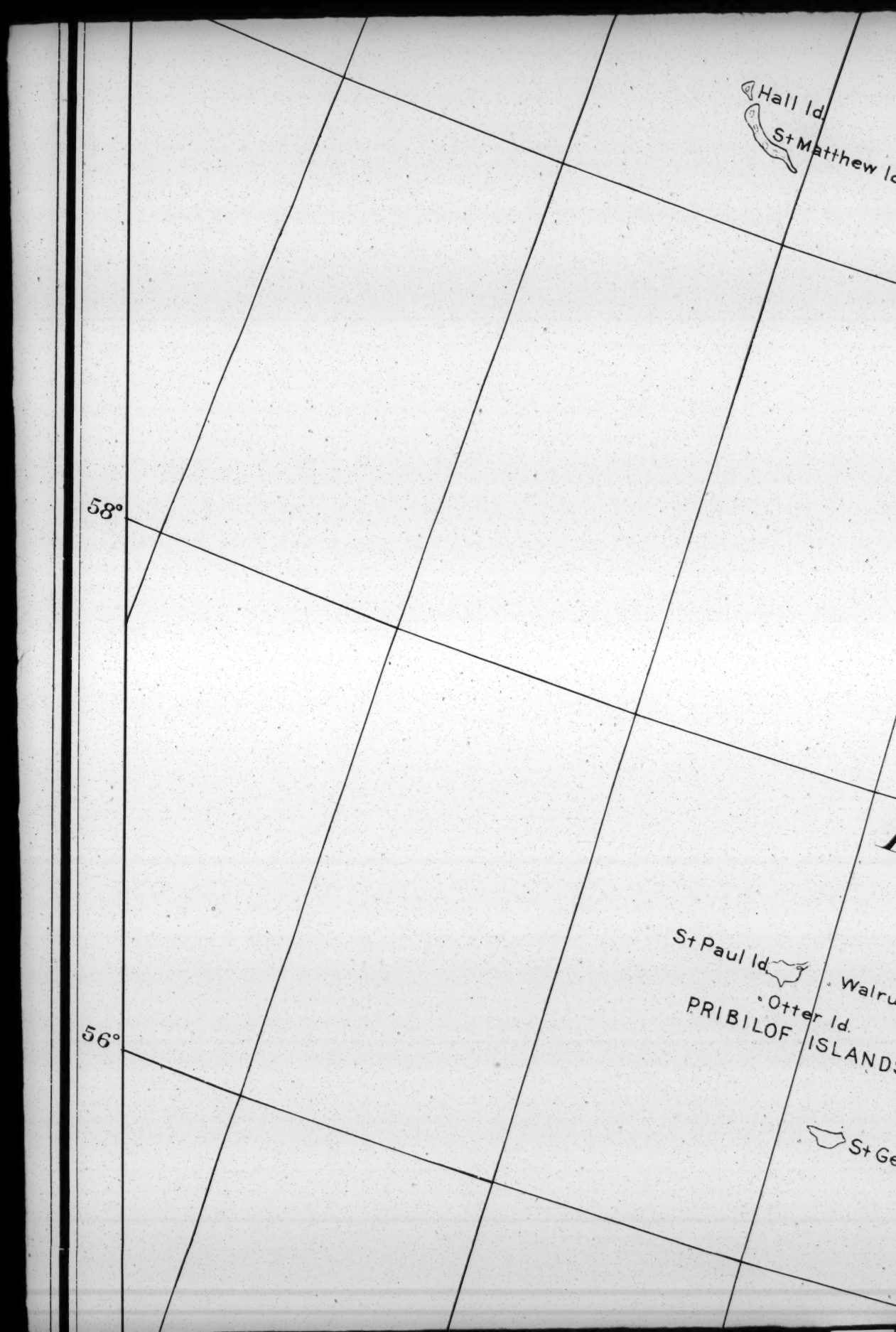
Rampart
Baker Cr
Talovana
LINE
Chena
Chena R
Fairbanks
Tortella
River
North Fork
YUKON
Charlie River
Washington Cr
Salchaket River
Goodpaster R
Middle Fork
TANANA
Volkmar R
Cantwell River
Silok R
Delta R
R A N G E
Mt Hayes
TELEGRAPH
Lake Mansfield
RIVER
Mt Kimball
Tolao R
Chisna
Lake Wagner
Mentasta Pass
McKinley
River
RIVER
Talkeet River
Gulkana R
Gakona R
Chistochina R
Batzulnetas
Chistochina
MILITARY
Louise Lake
Sanford R
Mt Sanford
Mt Drum
Mt Wrangell
Tazlina R
Copper Center
SUSHITNA
Matanuska R
CHUGACH
MOUNTAINS
COPPER
Mt Blackburn
Knik Arm
Knik R
Valdes Glacier
Taral
Chitina
Nizina
Hanagita Valley
Pt Campbell
Valdes
RIVER
Bremner R
Hope
Sunrise
Port Wells
Port Valdes
Ellamar
Fidalgo Bay
Port Nellie Juan
Naked I.
PRINCE WILLIAM
SOUND
Orca
Knight Id
Bering

Ogilvie
Hart R.
Little W
River
Tatonduk R.
Star
Eagle
Coal Cr.
North Fork
Klondike
River
McQuesten
River
Forty Mile
Forty Mile Cr.
Dawson
Janet Lake
BOUNDARY LINE
STEWART
RIVE
Indian R.
Nogold Cr.
Ogilvie
Lake Cr.
Ethel Lake
Sixty Mile Cr.
Scroggie Cr.
Macmi
Ladue Cr.
RIVER
Selkirk
Gardner Cr.
Scottie Cr.
Lewes
Klotassin
River
Little Salmon
River
Mt Allen
White
River
Nisling
River
Atshihik L.
Mt Natazhat
Kluane L.
River
Mt Logan
ST ELIAS
Alsek
Dezadeash L.
Kusawa
Chilkat Pass
DISTRICT



Miller
Little Wind R.
River
Bonnet Plume Pass
Hot Springs
Mayo Lake
Lansing R.
River
Janet Lake
RIVER
Nogold Cr.
Ethel Lake
Macmillan
River
Pelly
River
Selkirk
Lewes
Little Salmon R.
River
Big Salmon
River
South Branch
Rose
River
Quiet L.
Teslin
River
Nisutlin R.
Teslin L.
Nisutlin Bay
Main Branch
Pelly Lakes
McEvay Lake
Finlayson Lake
L. Lebarge
Atshikik L.
Nordenskiold R.
Takhini R.
White Horse
L. Marsh
River
Kusawa L.
Dezadeash L.
Caribou
L. Bennett
Tagish Lake
Davis L.
Hall R.
Atlin L.
Surprise L.
Jennings
Chilkat Pass

62°
60°
UNDARY
LINE
R.


Hall Id
St Matthew Id
58°
St Paul Id
Walru
Otter Id
PRIBILOF ISLAND
56°
St Ge

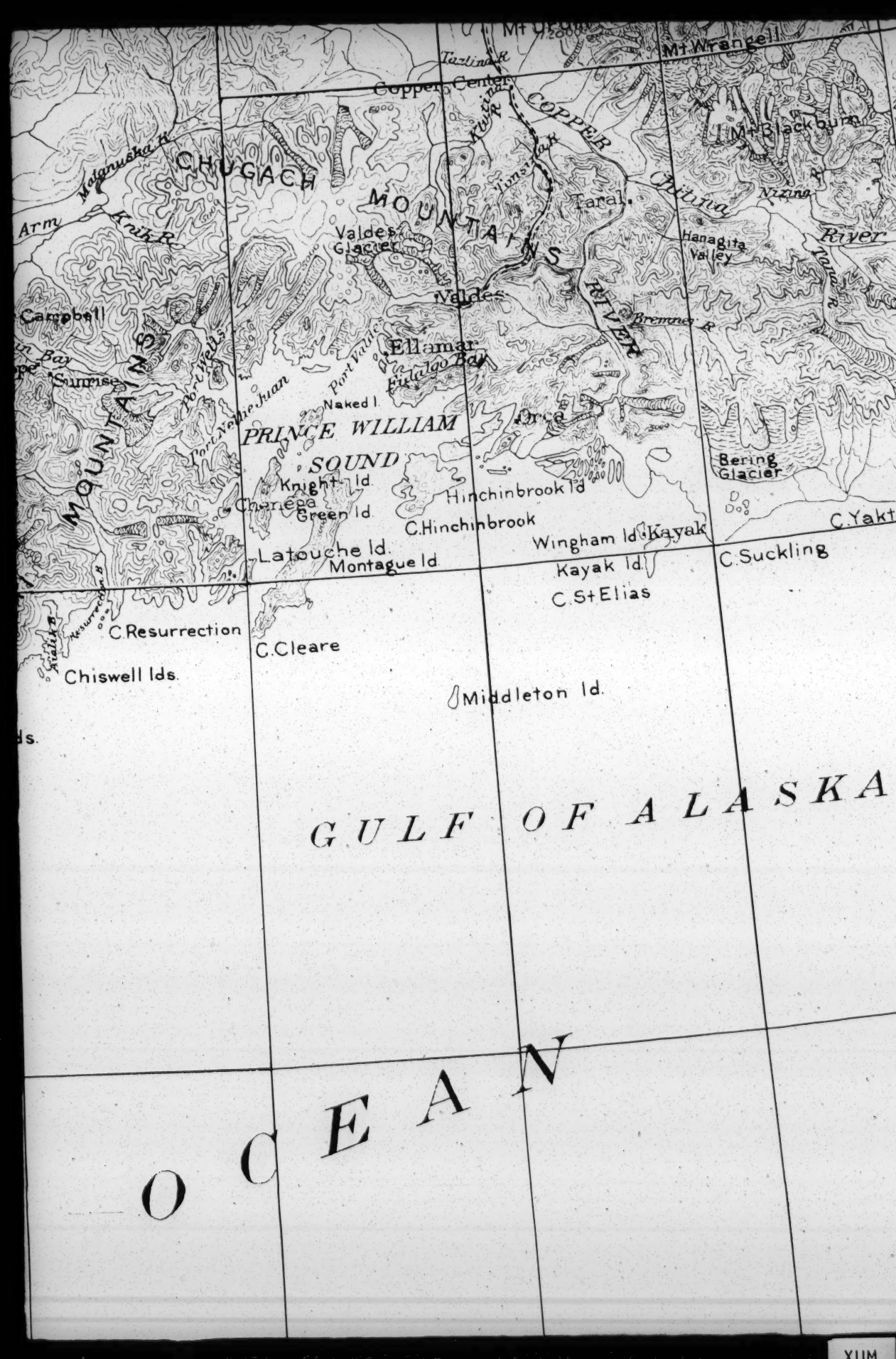
Pt. Dall
Hooper Bay
Hazen Bay
C. Vancouver
C. Etolin
Nelson Id
C. Mohican
Nunivak Id
C. Mendenhall
C. Corwin
C. Avinof
BERING SEA
w Id.
alrus Id.
NDS
t George Id

Azun R.
Hazen Bay
C. Vancouver
Nelson Id
Baird Inlet
C. Mohican
C. Etolin
Nunivak Id.
C. Mendenhall
C. Corwin
Kinak R.
Kuguklik R.
C. Avinof
KUSKOKWIM BAY
Goodnews Bay
Portage Bay
C. Newenham
C. Peirce
SEA

Kvichivak River
RIVER
KUSKOKWIM
Kwikli R.
Chulitna River
Tikchik Lake
Kanektok
Tikchik R.
Mulchatna R.
Chuitna R.
Togiak L.
Agulukpak L.
Aleknagik L.
Wood R.
Nushagak R.
Togiak R.
Togiak Bay
Nushagak
Kvichak R.
Iliamna Lake
Hagemeister Id.
Walrus Ids
Etolin Pt.
Protection Pt.
C Constantine
Naknek R.
Naknek L.
Ugaguk R.
Becharof Lake
Katmai
Katmai B.
BRISTOL BAY
Cold B.
Portage B.
Kialagvik Bay
Port Heiden
Seal Ids.
Aniakchak Bay
Kigulik Bay
Sutwik Id
Foggy C.
Tugidak Id.
3000
2000
1000

RIVER
Chulitna River
Chuitna R.
Lake Clark
Redoubt Pk
Iliamna Pk
Snug Harbor
COOK
Anchor P
Iliamna Lake
Kamishak Bay
Augustine Id.
Port Chath
Shaw Id
C. Douglas
Kvichak R.
Nushagak R.
Nushagak
Togiak L.
Aleknagik L.
Wood R.
Etolin Pt.
Protection Pt.
C Constantine
Naknek R.
Naknek L.
Hallo Bay
Kukak Bay
Ugaguk R.
Becharof Lake
Katmai
Katmai B.
SHELIKOF STRAIT
Northern Strait
Kodiak
Uyak
Karluk
Cold B.
Portage B.
Kialagvik Bay
Sitkalidak I
Afognak Id
Marmot Bay
Shuyak Strait
Kachem
Port Graha
Barr
Pt.
Tikchik R.
Mulchatna R.
Tikchik Lake
Aguluk pak L.
Igushik R.
Uyak B.
Oganik B.
Kodiak Id.
Chin
2000
1000
3000
5000

Copper Center
COPPER
Tazlina R.
Klutina R.
Tonsina R.
Yentna R.
SUSHI
Matanuska R.
CHUGACH
MOUNTAINS
Knik Arm
Knik R.
Valdes Glacier
Valdes
Tyonek
Pt. Possession
Frel
Pt. Campbell
Turnagain Bay
Hope
Sunrise
Port Wells
Port Nellie Juan
Port Valdez
Ellamar
Fidalgo Bay
Naked I.
Orca
PRINCE WILLIAM
SOUND
Knight Id.
Chenega
Green Id.
Hinchinbrook Id.
C. Hinchinbrook
Wingham
Latouche Id.
Montague Id.
Kayak
C. St El
Trading B.
INLET
E. Foreland
Kena
Kalgin I.
Kenai L.
Kasilof R.
Tustumena L.
KENAI MOUNTAINS
C. Resurrection
C. Cleare
Chiswell Ids.
Middleton Id.
Homer
Coal Bay
Seldovia
Pye Ids.
Nuka B.
Pt. Gore
Port Lick
Chugach Ids.
GULF OF
Barren Ids.
Pt. Banks
Marmot Id.
Chiniak Bay
OCEAN


Mt Wrangell
Copper Center
COPPER
Mt Blackburn
CHUGACH
MOUNTAINS
Taral
Chitina
Nizina
River
Hanagita Valley
Arm
Knik R
Valdes Glacier
Valdes
RIVER
Campbell
Bremner R
Ellamar
Fidalgo Bay
Port Wells
Port Valdes
Sunrise
Naked I.
PRINCE WILLIAM
SOUND
Orca
Bering Glacier
Knight Id.
Hinchinbrook Id
Chenega
Green Id.
C.Hinchinbrook
Wingham Id
Kayak
C.Yakt
Latouche Id.
Montague Id.
Kayak Id.
C.Suckling
C.St Elias
C.Resurrection
C.Cleare
Chiswell Ids.
Middleton Id.
GULF OF ALASKA
OCEAN

N M T S
Mt Natazhat
Mt Logan
ST ELIAS
Hubbard Glacier
Mt St Elias
Malaspina Glacier
Yakutat Bay
Yakutat
Ocean C.
Alsek River
Kluane L.
Dezadeash L.
Kusawa L.
Chilkat Pass
YUKON DISTRICT
BRITISH COLUMBIA
RANGE
Takhin R.
Johns Hopkins Glacier
Muir Glacier
Brady Glacier
Glacier Bay
C. Fairweather
Lituya Bay
Harbor Pt.
Icy Pt.
Cross Sound
Yakobi Id.
Lisianski St.
C. Edward
Salisbury S
Kru
A

Kluane L.
River
Tana R.
Mt. Logan
ST. ELIAS
Hubbard Glacier
Alsek
River
Dezadeash L.
Chilkat Pass
YUKON DISTRICT
BRITISH COLUMBI
Mt. St. Elias
Malaspina Glacier
C. Yaktag
kling
Yakutat Bay
Yakutat
Ocean C.
RANGE
Johns Hopkins Glacier
C. Fairweather
Lituya Bay
Harbor Pt.
Icy Pt.
Brady Glacier
SKA
Cross Sou
Yakobi
C.E
Sal
30°
178°
176°
174°

White Horse
River
Nisutlin R.
Teslin L.
Nisutlin Bay
BOUNDARY LINE
L. Marsh
Kusawa L.
Caribou
Davis L.
Hall R.
L. Bennett
Tagish Lake
Taku Arm
Atlin L.
Surprise L.
Jennings R.
Atlin
Hayes R.
Ptarmigan Pass
Disella L.
Tuya L.
Bennett
Chilkoot Pass
White Pass
Slocah L.
Katin
Nakina R.
Dyea
Skagway
Slocah R.
Inklin R.
Tuya R.
Dease L.
Tanzilla R.
Haines
Chilkat
Takhin R.
Taku R.
Lynn Canal
Muir Glacier
Glacier Bay
Juneau
Douglas
Pleasant Id.
Douglas Id.
Icy Strait
Shettisham
Stikine River
First South Fork
Hooniah
Chichagof Id.
CHATHAM
Admiralty Id.
Seymour Canal
Stephens Passage
Sumdum
Endicott Arm
Scud R.
Tenakee Inlet
ALEXANDER
Hooniah Sound
C. Edward
Killisnoo
Port Houghton
Rodman
FREDERICK SOUND
Salisbury Sound
Kupreanof Id.
Petersburg
Kruzof Id.
SITKA
Pt. Gardner
Mitkof Id.
Wrangell
Sitka Sound
Baranof Id.
STRAIT
ARCHIPELAGO
Sumner Strait
Zarembo Id.
Wrangell Id.
Bradfield Canal
Shakan
Prince of Wales Isl.
CLARENCE STRAIT
Cleveland Pen.
Revillagigedo Id.
C. Ommaney
Christian Sound
Coronation Id.
Heceta Id.
Kasaan
Hollis
Klawak
Grindall
Gravina
Ketchikan
Annette
IPHIGENIA BAY
172°

White Horse
River
Nisutlin R.
Teslin L.
Nisutlin Bay
BOUNDA
LINE
L. Marsh
Hall R.
Davis L.
Jennings R.
Dezadeash L.
Kusawa L.
Caribou
L. Bennett
Tagish Lake
Taku Arm
Atlin L.
Surprise L.
Hayes R.
Atlin
Ptarmigan Pass
Chilkat Pass
YUKON DISTRICT
BRITISH COLUMBIA
Bennett
Chilkoot Pass
White Pass
Slocah L.
Katin
Nakina R.
Slocah R.
Inklin R.
RANGE
Dyea
Skagway
Chilkat R.
Haines
Chilkat
Takhin R.
Johns Hopkins Glacier
Muir Glacier
Lynn Canal
Taku R.
Glacier Bay
Brady Glacier
Juneau
Douglas
Pleasant Id.
Douglas Id.
Lituya Bay
Harbor Pt.
Icy Pt.
Icy Strait
Hoonah
CHATHAM
Admiralty Id.
Seymour Canal
Stephens Passage
Sheltisham
Sumdum
Endicott Arm
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Chichagof Id.
Yakobi Id.
Tenakee Inlet
ALEXANDER
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Port Houghton
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Kupreanof Id.
Sitka Sound
Baranof Id.
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Shakan
C. Ommaney
Christian Sound
Coronation Id.
Heceta Id.
IPHIGENIA BAY

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Tuya R.
Dease L.
Tanzilla R.
58°
Stikine River
First South Fork
Scud R.
56°
Mitkof Id.
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Wrangell Id.
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CLARENCE STRAIT
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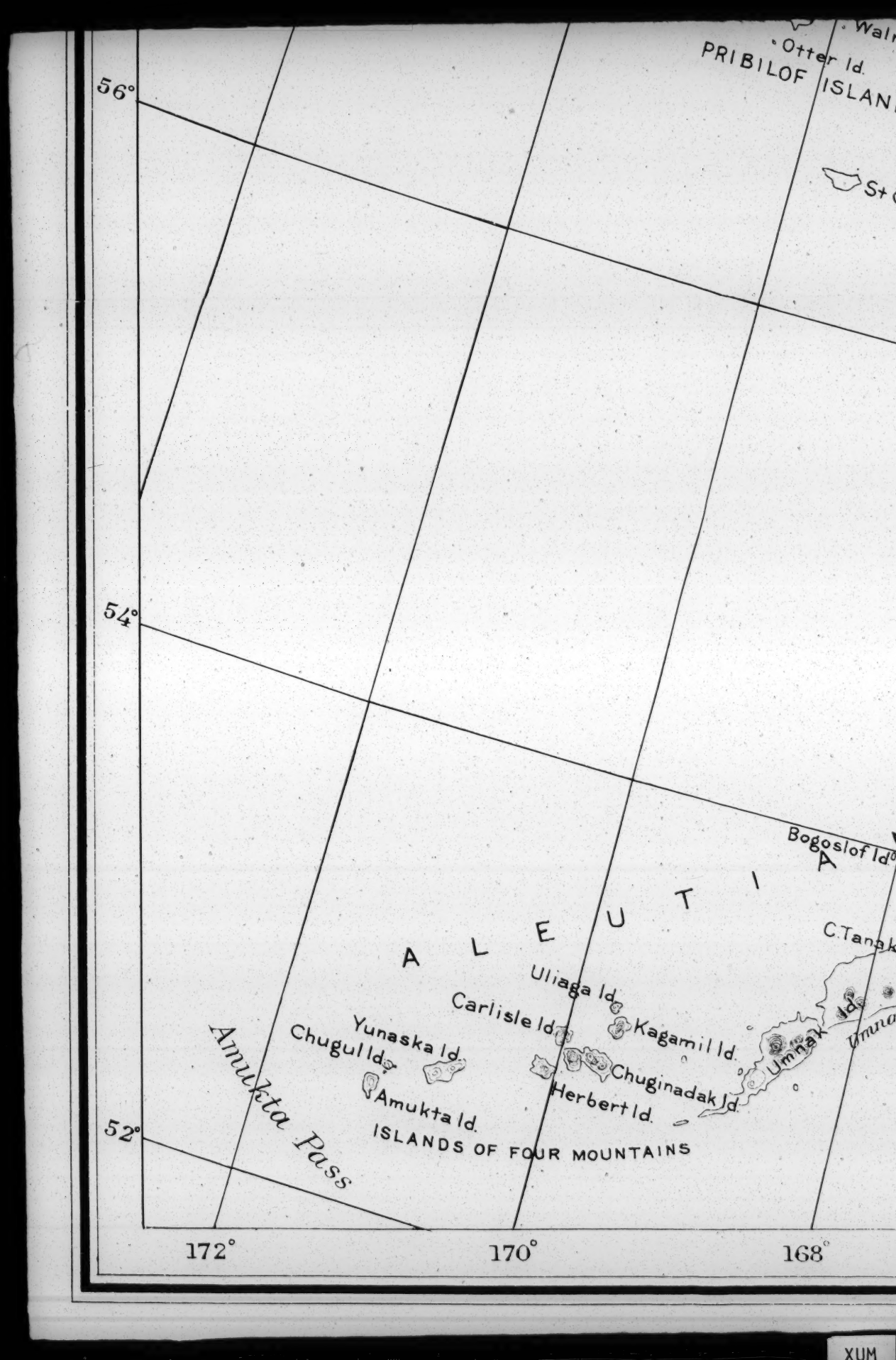
56°
54°
52°
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170°
168°
Otter Id.
PRIBILOF ISLAN
St
Bogoslof Id.
A L E U T I A
C. Tanak
Uliaga Id.
Carlisle Id.
Kagamil Id.
Umnak Id.
Yunaska Id.
Chugul Id.
Amukta Id.
Chuginadak Id.
Herbert Id.
Amukta Pass
ISLANDS OF FOUR MOUNTAINS

Walrus Id.
ANDS
St George Id.
SEA
ISLANDS
Amak Id.
Isanotski Strait
Marzhovoi Bay
Cold Bay
C. Lapin
Shishaldin Vol.
Unimak Id.
C. Sarichef
Ikatan Bay
C. Pankof
Unimak Pass
Pogromni Vol.
C. Lazaref
Akutan Bay
Akun Id.
Akutan Id.
Dutch Harbor
Akutan Pass
Makushin Mt.
Udalta
Unalaska
Makushin Bay
Biorka Id.
Unalaska Id.
Sannak Id.
SANNAK IDS.
FOX ISLANDS
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164°
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ISLANDS
Isanotski Strait
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Pavlof Bay
C. Lapin
Shishaldin Vol.
Unimak Id.
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Akutan Pass
Udalta
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Unalaska Pass
Biorka Id.
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FOX ISLANDS
NO
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164°
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Protection Pt.
C. Constantine
Ugaguk R.
Becharof Lake
BRISTOL BAY
Portage
Kialagvik Bay
Port Heiden
Seal Ids.
Aniakchak Bay
Sutwik Id.
Foggy C.
Kigulik Bay
Chignik Bay
Chignik
Kudobin Ids.
Port Moller
Nelson Lagoon
Semidi Ids.
Mitrofania Id.
Stepovak Bay
Ivanof Bay
Unga Strait
Korovin Id.
Unga Id.
Sandpoint
Popof Id.
Unga
Popof Strait
Dolgoi Id.
Apollo
Nagai Id.
Big Koniuji Id.
Little Koniuji Id.
SHUMAGIN IDS.
PACIF
ORTH
160°
158°
156°

C. Constantine
Ugaguk R.
Becharof Lake
Katmai
Katmai B.
BRISTOL BAY
SHELIKOF
Cold B.
Portage B.
Kiatagvik Bay
Karluk
Port Heiden
Seal Ids.
Aniakchak Bay
Kagulik Bay
Sutwik Id.
Foggy C.
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Semidi Ids.
Mitrofania Id.
Chirikof Id
Korovin Id
Big Koniuji Id.
Little Koniuji Id.
IDS.
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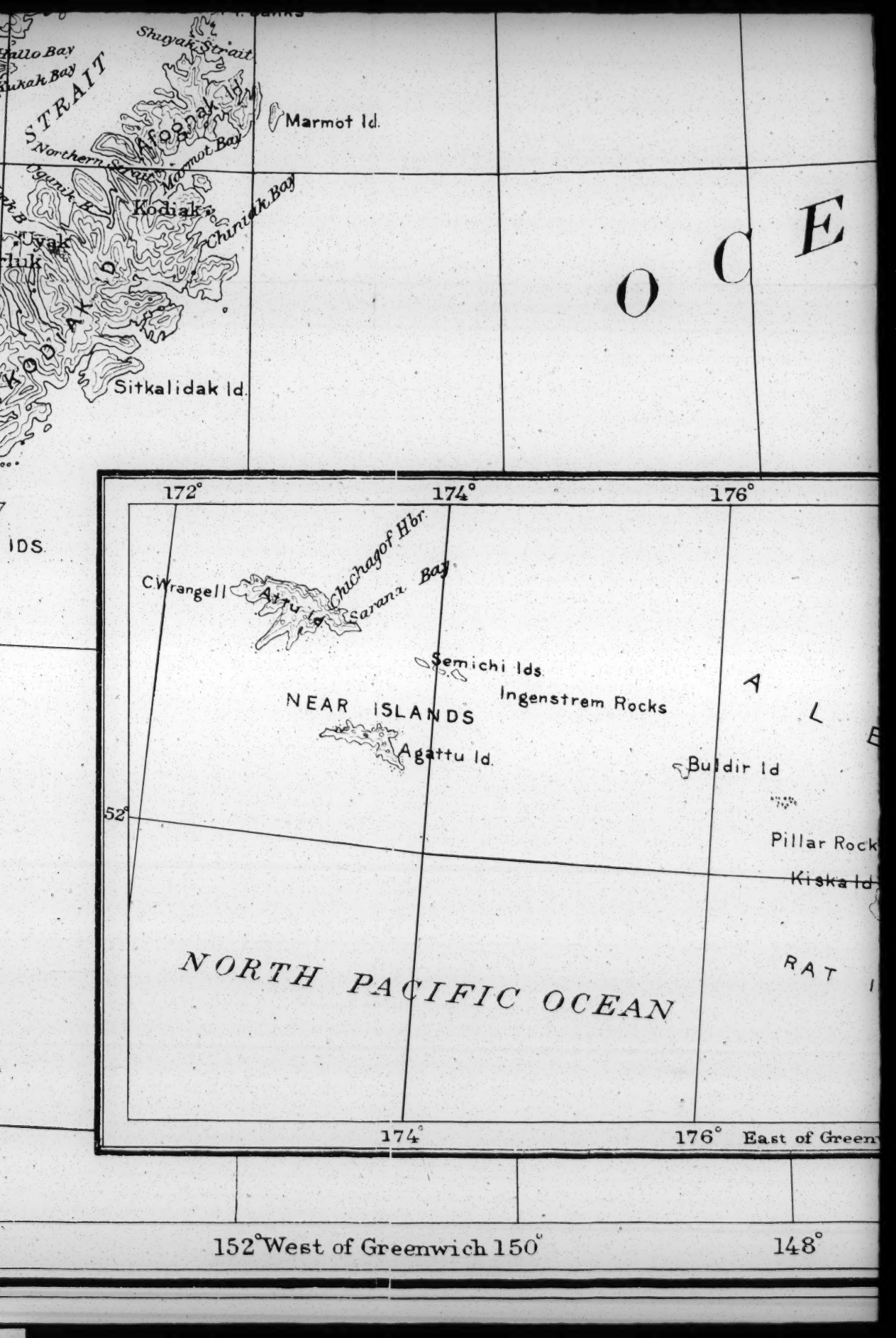
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STRAIT
Afognak Bay
Marmot Id.
Northern Entrance
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Ogunik B.
Kodiak
Chiniak Bay
KODIAK
Sitkalidak Id.
OCE
172°
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176°
C. Wrangell
Attu I.
Chichagof Hbr.
Sarana Bay
Semichi Ids.
Ingenstrem Rocks
NEAR ISLANDS
Agattu Id.
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52°
Pillar Rock
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NORTH PACIFIC OCEAN
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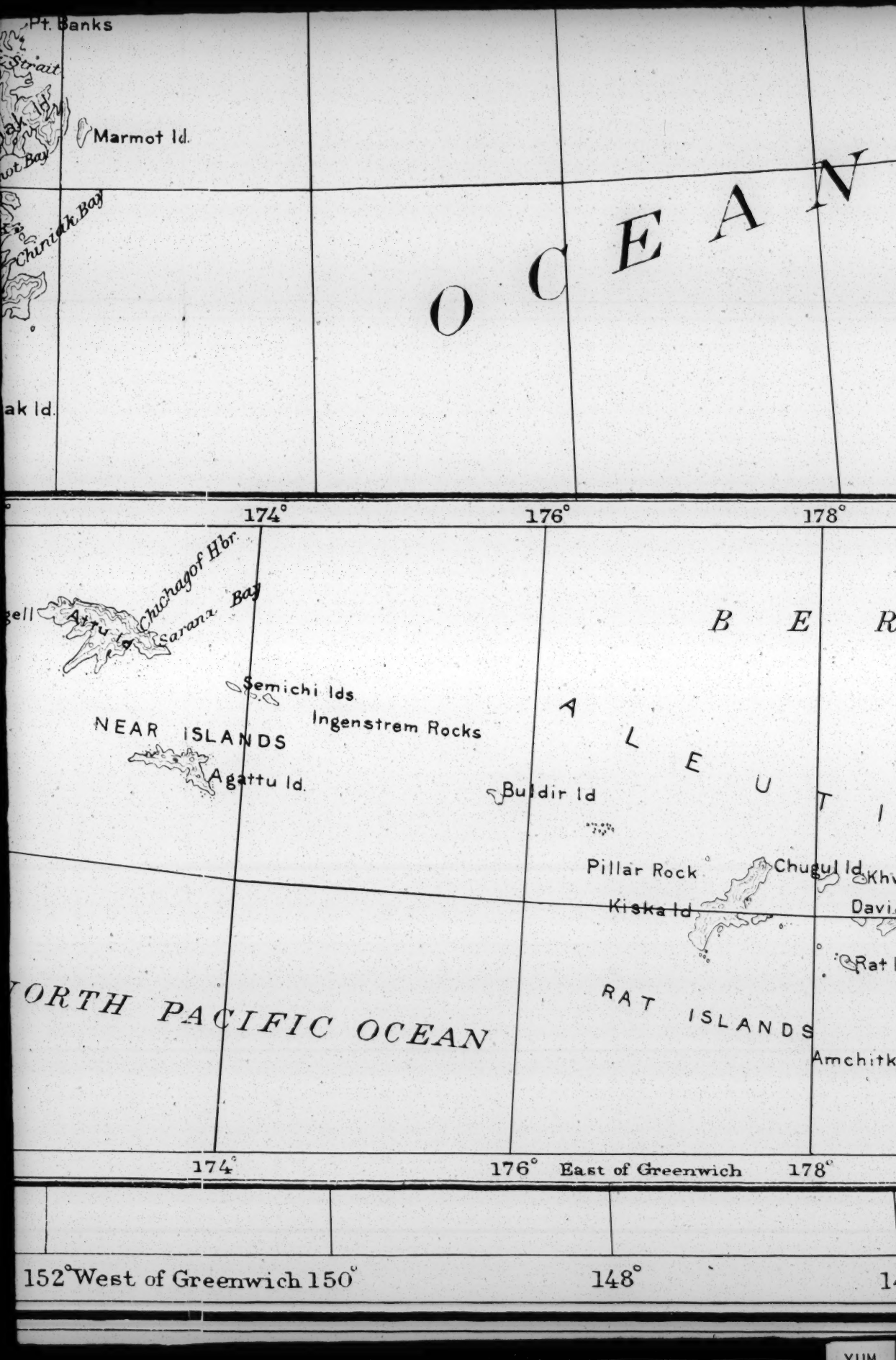
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Semisopochnoi Id.
Little Sitkin Id.
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Constantine Hbr.
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Gareloi Id.
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Ogliuga Id.
Skagul Id.
Unalga Id.
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Ulak Id.
Amatignak Id.
Sea Otter Id.
Bay of Islands
Kanaga
Adak
Greatsitkin Id
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Igitkin
Chug
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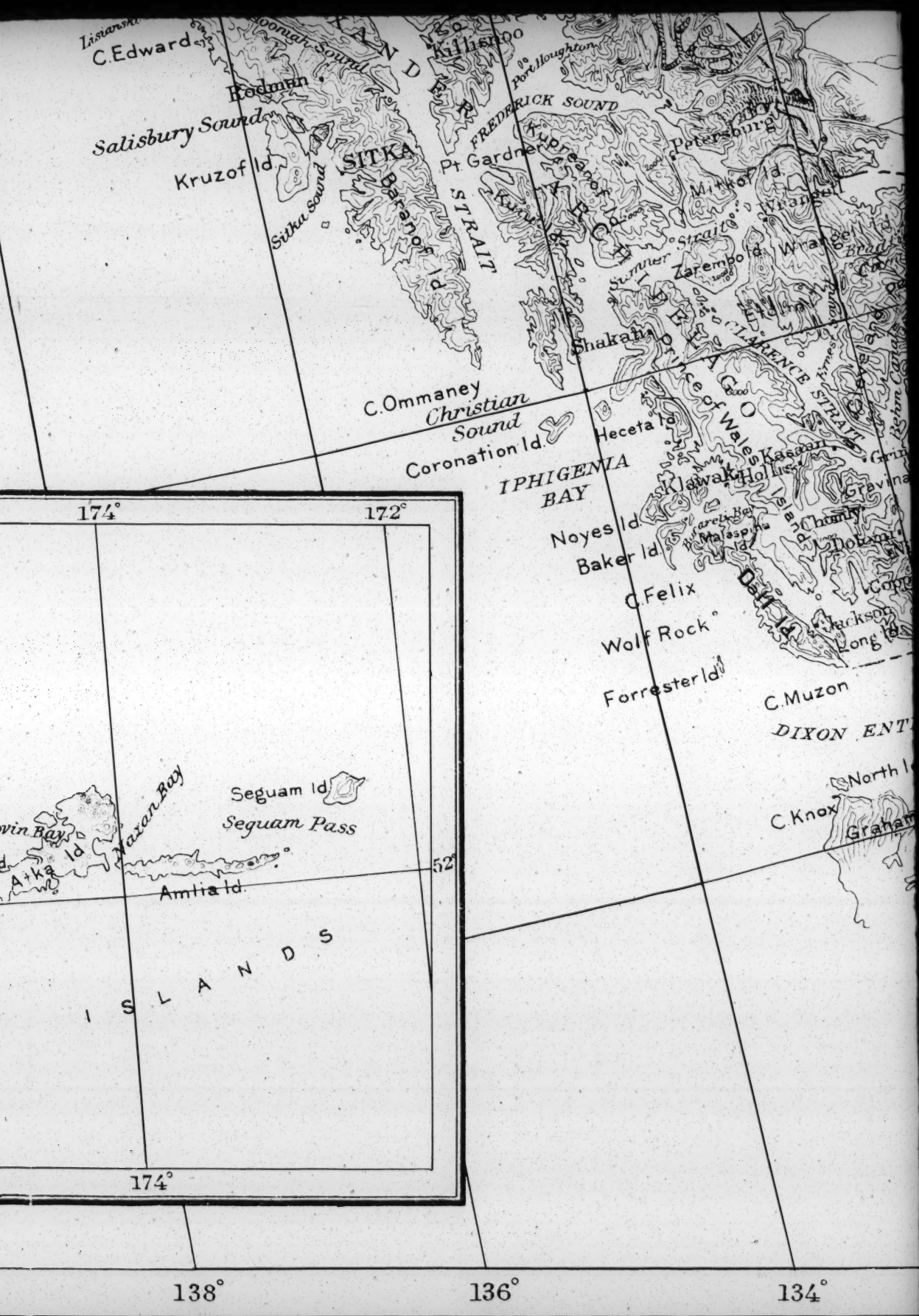

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FREDERICK SOUND
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Petersburg
Mitkof Id.
Wrangell
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Shakan
CLARENCE STRAIT
C.Ommaney
Christian Sound
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Heceta Id.
IPHIGENIA BAY
Noyes Id.
Baker Id.
C.Felix
Wolf Rock
Forrester Id.
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Klawak
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Malaspina Id.
Dall Id.
Jackson
Long Id.
C.Muzon
DIXON ENT
North I
C.Knox
Graham
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ISLANDS
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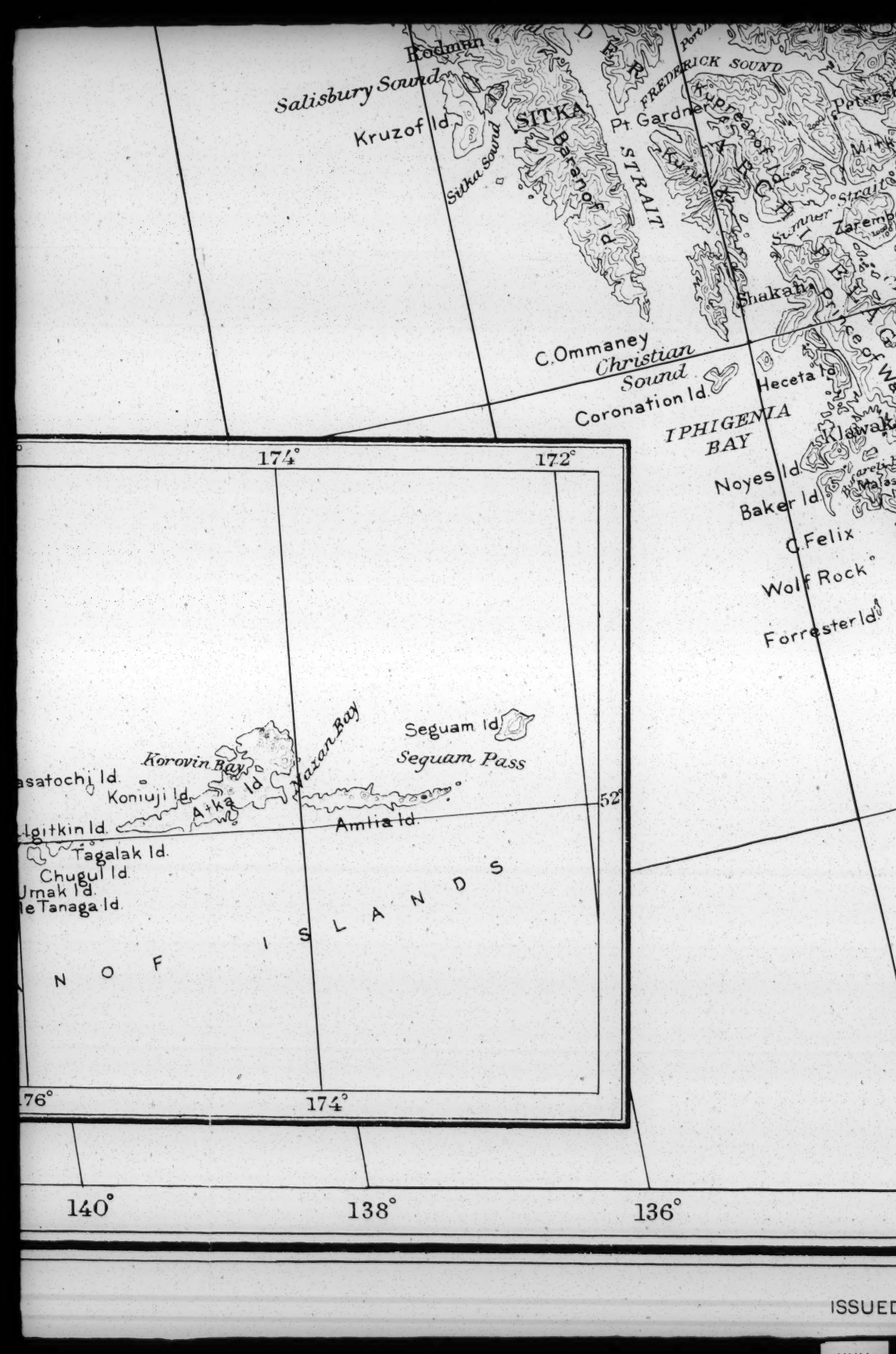
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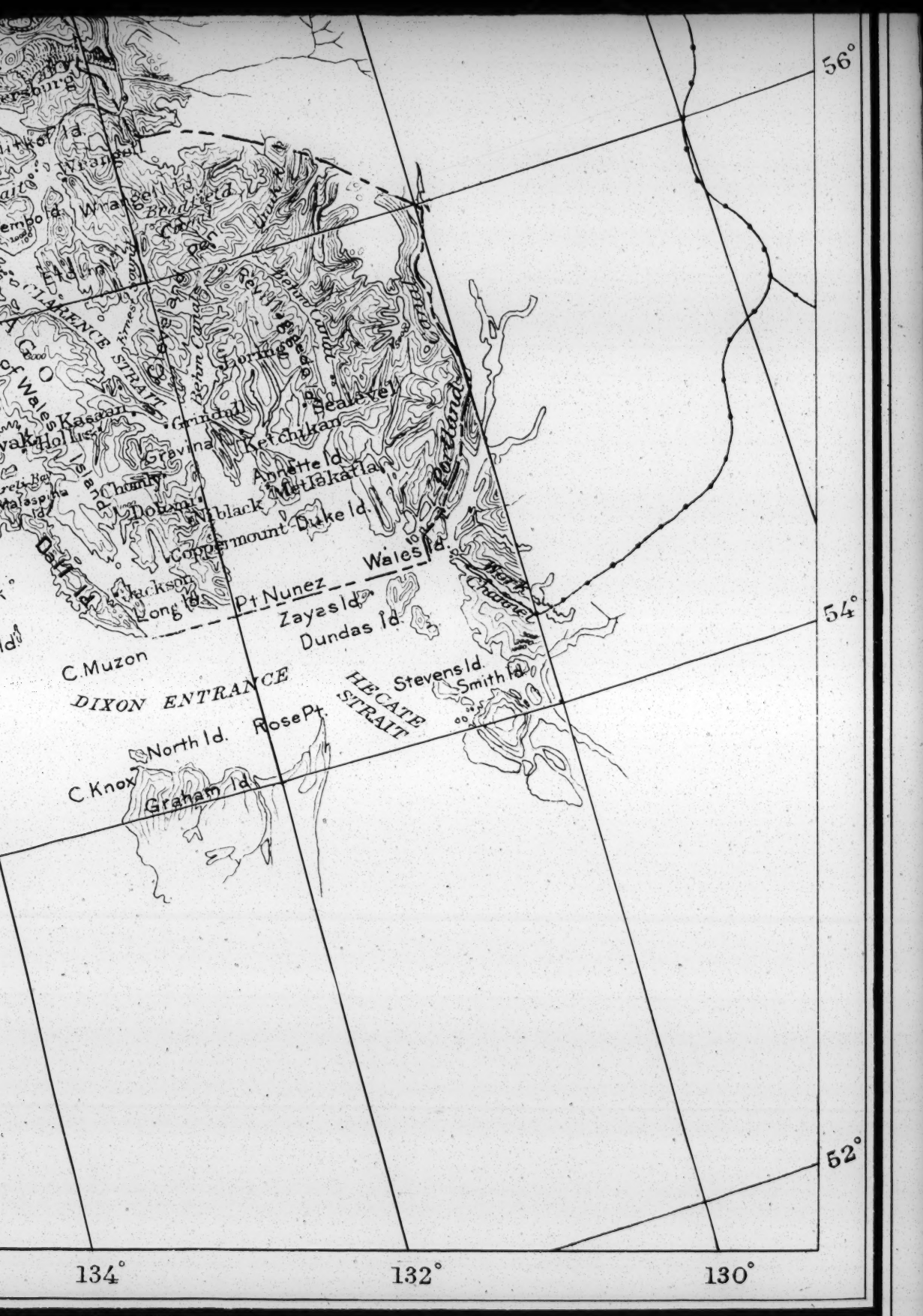

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VOL. XV, No. 5 WASHINGTON MAY, 1904

THE NATIONAL GEOGRAPHIC MAGAZINE

THE BUREAU OF FISHERIES*

HOW THE RICH FISHERIES OF THE UNITED STATES ARE PROTECTED AND NEW FISHING GROUNDS DISCOVERED OR CREATED

BY DR BARTON WARREN EVERMANN

ASSISTANT IN CHARGE, DIVISION OF SCIENTIFIC INQUIRY, BUREAU OF FISHERIES

IN order that we may understand clearly the purposes, scope, and methods of the Bureau of Fisheries, it will be helpful to recall briefly the circumstances leading up to and attending its inception. In 1870 committees of the legislatures of Massachusetts and Rhode Island and the State Fish Commissions of Connecticut, Vermont, and New Hampshire made inquiries concerning the reported decrease in the abundance of certain species of important food-fishes and the cause of the decrease, if such had occurred. The Massachusetts committee found that there had been no real decrease. The Rhode Island committee, with practically the same evidence, concluded that there had been a serious decrease, but were not agreed as to the cause. New Hampshire and Vermont were sure that the shad and salmon fisheries were being depleted, and attributed it to the use of traps in and about the mouth of the Connecticut River. Connecticut was willing to abolish traps if Massachusetts would put in fishways at all the dams on the Connecticut River in that State and if New Hampshire and Vermont would furnish sufficient quantities of salmon and shad fry for restocking the river. Vermont, New Hampshire, and Massachusetts failed to keep the agreement and Connecticut soon began licensing traps.

So diverse were the opinions expressed by different fishermen and the conclusions reached by the different state committees that it became at once apparent that the actual facts could be determined only through very careful investigation.

In view of these facts, it was thought that the condition of the fisheries should receive investigation by the federal government, and the following bill was introduced in the House of Representatives by the Hon. Henry L. Dawes, of Massachusetts.

*An address before the National Geographic Society Friday evening, February 12, 1904

"Whereas it is asserted that the most valuable food-fishes of the coast and the lakes of the United States are rapidly diminishing in number, to the public injury, and so as materially to affect the interests of trade and commerce: Therefore,

"*Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled*, That the President be, and he hereby is, authorized and required to appoint, by and with the advice and consent of the Senate, from among the civil officers or employés of the government, one person of proved scientific and practical acquaintance with the fishes of the coast, to be Commissioner of Fish and Fisheries, to serve without additional salary.

"SEC. 2. *And be it further resolved*, That it shall be the duty of said Commissioner to prosecute investigations and inquiries on the subject, with the view of ascertaining whether any and what diminution in the number of the food-fishes of the coast and the lakes of the United States has taken place; and, if so, to what causes the same is due; and also whether any and what protective, prohibitory, or precautionary measures should be adopted in the premises; and to report upon the same to Congress."

This bill became a law February 9, 1871, and President Grant appointed as Commissioner of Fish and Fisheries Professor Spencer F. Baird, then Assistant Secretary of the Smithsonian Institution. The new position carried no salary, but Professor Baird was willing to perform the duties of the new office, in addition to those of Assistant Secretary of the Smithsonian Institution, without additional salary.

Early in June, 1871, Professor Baird established his headquarters at Woods Hole, Massachusetts, this being in the region where the alleged decrease was most clearly manifested, and entered upon the investigations for which the Commission had been created.

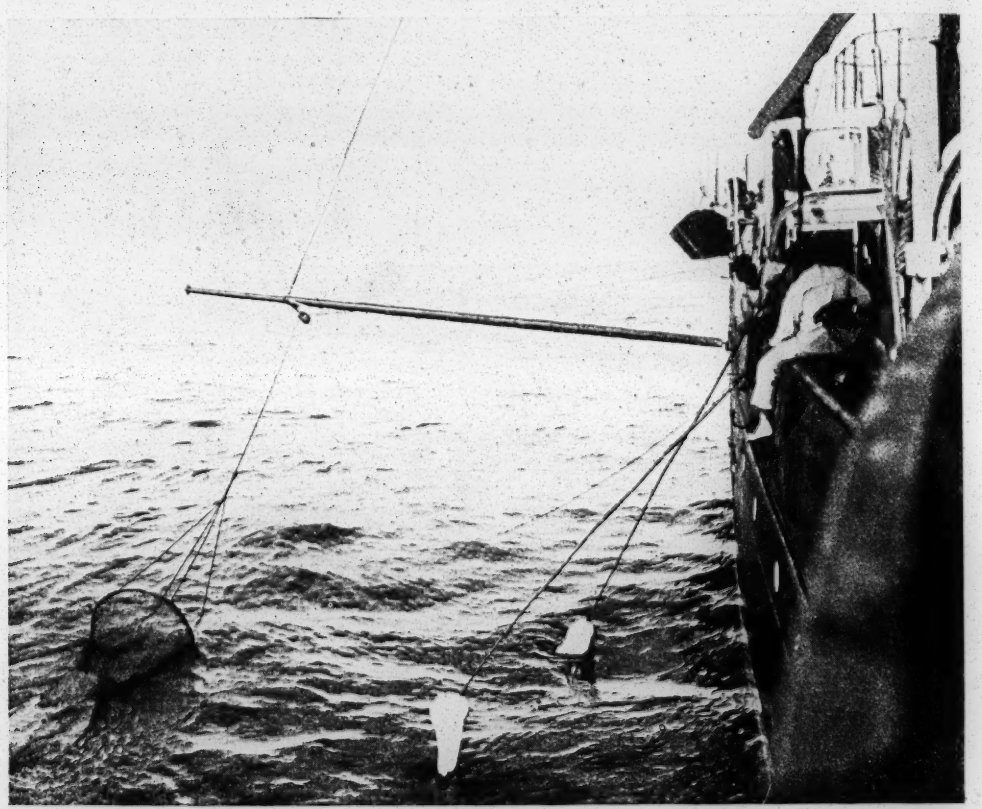
The contradictory opinions developed by the state inquiries regarding the habits of our best known food-fishes showed at once that the fishermen could not be depended upon for accurate observations or expression of unbiased opinion. It was necessary therefore that the habits or life-histories of the important food-fishes should receive thorough study before satisfactory conclusions could be reached. With the able assistance of Dr Theodore Gill, a definite and comprehensive plan of inquiry was formulated. Professor Baird's training as a naturalist, as well as his tastes, gave him faith in the exact methods of science in the investigation of all economic questions; and it was the scientific method which characterized the very first inquiries undertaken by the Commission. The methods to be pursued were those of science, and the Fish Commission therefore began its career as a scientific bureau.

It soon became evident that the fisheries had greatly decreased in value, and that destructive methods—overfishing, the building of dams and other obstructions in coastwise streams, and the pollution of their waters by refuse from sawmills and other manufactories—were among the most potent causes which had led to the decrease.

The only adequate solution of the problem seemed to be the establishment of proper fishery regulations based upon accurate knowledge of the habits of the fishes, and the development of methods of artificial propagation as applied to those species in danger of most serious depletion. The initial efforts of the Commission were therefore directed, first, toward securing accurate knowledge of the habits, abundance, and distribution of the more important species of food-fishes, and, second, the development of methods by means of which these species might be propagated artificially.

This Bureau was established as the United States Commission of Fish and Fisheries, and the chief of the Bureau was known as the United States Commissioner of Fish and Fisheries. The Commission remained as an unattached bureau, not being placed in any Cabinet department, until the establishment of the Department of Commerce and Labor.

On the 1st of July, 1903, the Commission was transferred to that department and the name was changed to "Bureau of Fisheries." Professor Baird served as Commissioner from the organization of the Commission until his death, in 1887. Dr G. Brown Goode was then appointed Commissioner, but agreed to serve only until a salary could be attached to the position, as he preferred to give his energies to the development of the United States National Museum. The Congress attached a salary to the Commissionership early in 1888, when Dr Goode resigned and Col. Marshall McDonald was appointed Commissioner. Colonel McDonald had for many years been one of the most energetic and capable assistants in the Commission. He served as Commissioner until his death, in 1895, when Capt. John J. Brice, U. S. N., retired, was appointed Commissioner. He served until February, 1898, when he was superseded by the present Commissioner, Hon. George M. Bowers, who has continued the wise and liberal policy of Baird and McDonald, and under his administration the scientific and economic results are constantly increasing in importance and value.



Dragging the Surface and Dip Nets from the *Albatross*

Although the Commission was originally established simply to inquire into the condition of the fisheries of the sea-

coast and lakes, the matter of the actual increase of the food-fishes by means of artificial propagation was added in the second year of its existence, thus establishing a twofold function. The beginnings of the Fish Commission were very modest. The appropriations made by Congress were small in amount, and the personnel at first consisted of but one man, and he without salary. But as the importance and possibilities of the work came to be more keenly appreciated, the scope of the Commission increased and the work became differentiated into a number of divisions.

PRESENT ORGANIZATION OF THE BUREAU

For purposes of administration the work of the Bureau of Fisheries is conducted by and through the following offices and divisions:

1. *Administration*, consisting of the Commissioner's office, that of the Deputy Commissioner, the chief clerk, engineer and architect, library, disbursing office, and the necessary clerical force.

The duties of the Commissioner, as chief of the Bureau, have already been sufficiently defined. Those of the Deputy Commissioner, chief clerk, and disbursing officer are sufficiently defined by the appellations. The engineer and architect is charged with all matters pertaining to planning and constructing the various fish-cultural stations. This includes the selection of hatchery sites in so far as engineering problems are concerned, the designing and construction of hatchery buildings, superintendents' residences, and all other necessary buildings, the laying out and construction of the necessary ponds, fishways, dams, and flumes, and all other matters of construction and civil and mechanical engineering.

2. DIVISION OF INQUIRY RESPECTING FOOD-FISHES

This division is usually known as the Division of Scientific Inquiry. The assistant in charge is charged with the apportionment and direction of all the research work of the Bureau. He gives consideration to the various lines of scientific investigation which are proposed or which the Bureau might undertake, determines or approves the methods and means to be employed, and recommends them to the Commissioner, coördinates and directs all research work of the Bureau, and examines all reports of investigations, whether carried on by the regular staff or by employés selected temporarily for special inquiries.

To this division belong all investigations and researches pertaining to the physical and chemical characteristics of the waters of the United States, including the seas as well as the lakes, rivers, and smaller streams, in so far as these are factors in determining the character of aquatic life; the life histories, habits, food, enemies, abundance, and distribution of food-fishes and other aquatic animals and of aquatic plants, whether of the lakes and rivers or of the seas. It makes inquiries into the causes of decrease of food-fishes, wherever found, studies the various species and the various regions in the interests of fish-culture, makes the biological investigations necessary for the proper selection of sites for fish-cultural stations, and investigates the fishing grounds of the Atlantic, Gulf, and Pacific coasts, as well as those of the interior waters and our island possessions, in the interests of fish-culture and the commercial fisheries.

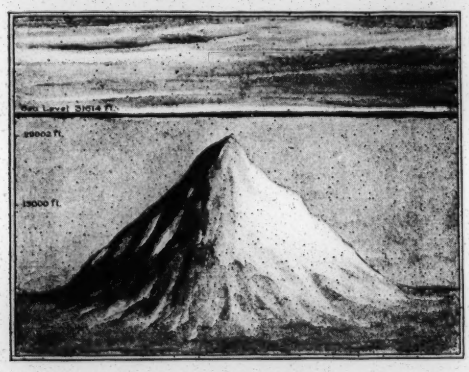
A few of the more important lines of inquiry may be mentioned in detail:

1. *On the Coasts and the High Seas.*—Besides a number of smaller vessels such as the *Bluewing*, *Phalarope*, and *Merganser*, the Bureau has 3 vessels of larger size. These are the *Albatross*, *Fish Hawk*, and *Grampus*.

The *Albatross* is an iron twin-screw steamer 234 feet long, 27 feet 6 inches beam, and 1,074 tons displacement. She was built at Wilmington, Delaware, at

a cost of $190,800, including outfit and special equipment. She was launched August 19, 1882, and went into commission November 11 following, with Lieutenant (now Commander, U. S. N., retired) Z. L. Tanner as commanding officer. Captain Tanner had superintended the construction of the vessel and was its able and efficient commander for nearly 12 years. To Captain Tanner more than to any other one man is due the credit for the great scientific and economic results of the investigations made by the *Albatross*.

The *Albatross* was built expressly for use in investigating questions connected



Picture of the Highest Mountain in the World Set in the Greatest Ocean Depth

If Mt Everest (29,002 feet) were set down in the Nero Deep (31,614 feet) there would still be nearly one-half mile of water above its summit.

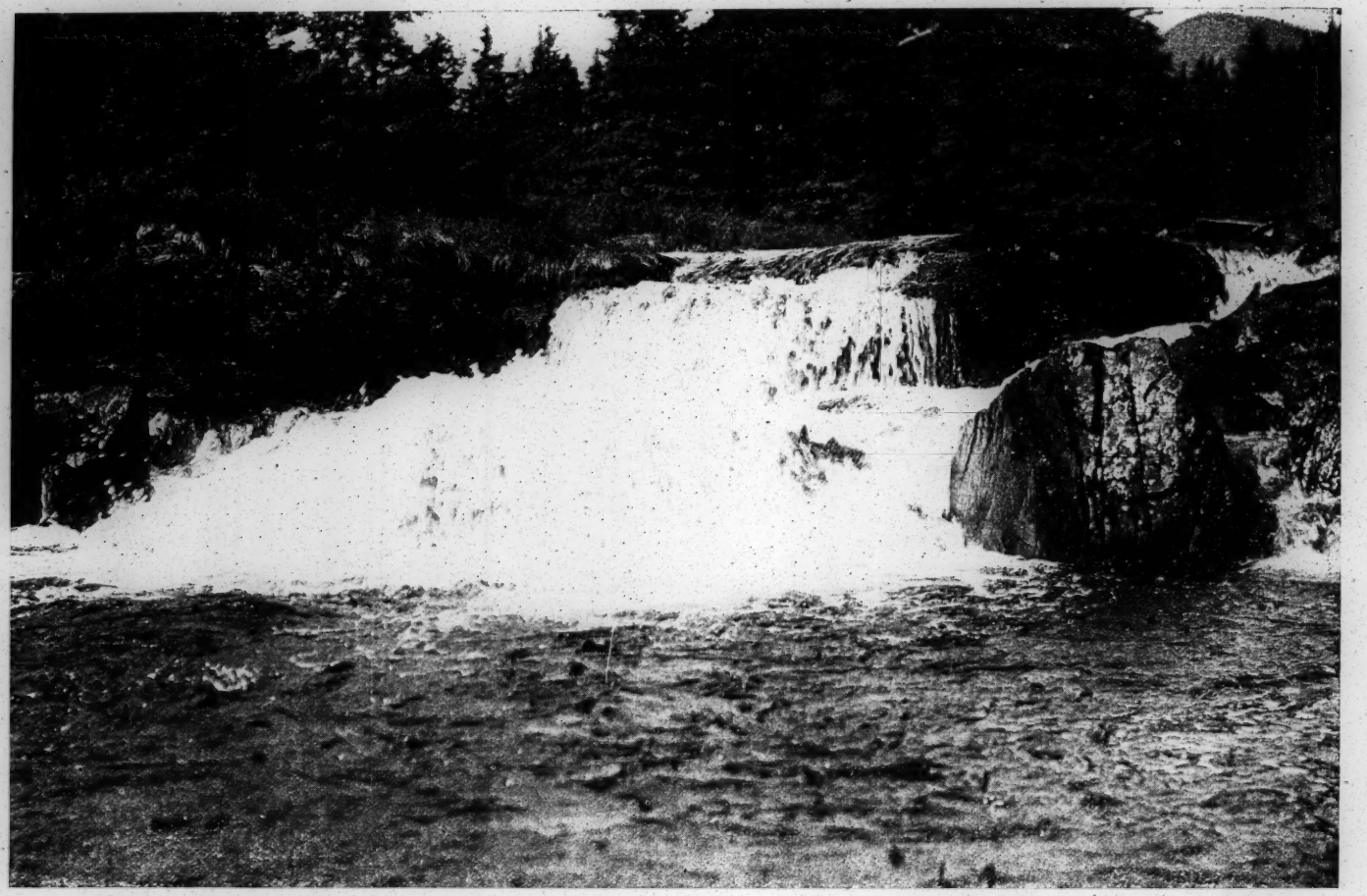
with the high seas, such as ocean temperatures, densities, depths, currents, character of bottom and distribution of life; the movements of pelagic and anadromous fishes as well as others which go in schools; the location, extent, and character of off-shore fishing banks; for all these matters have bearing upon the commercial fisheries.

The vessel is admirably adapted to the purposes for which she was designed. There are comfortable rooms for the naturalists and other members of the civilian staff, and 2 laboratories well equipped with reagents, preservatives, and appropriate scientific literature, where the collections may be cared for and scientific studies carried on. The vessel is electric-lighted throughout, has distilling and cold storage plants, photographic dark-room, search-light, and special search-lights for submarine use, which the *Albatross* was the first to use. The *Albatross* was the first vessel ever built expressly for scientific work along biologic lines on the high seas, and is certainly the best equipped vessel in the world for that purpose. She is officered and manned from the United States Navy, but has a civilian staff consisting of a chief naturalist, an assistant naturalist, a fishery expert, photographer, and, on special cruises, experts in hydrography, thalassography, and other lines.

The *Albatross* has been principally engaged in developing the resources naturally existing along our coasts, and the fishing grounds which are unknown or little known to our fishermen. In doing this the bottom over very wide areas must be examined with great detail. Lines of soundings must be run at close intervals to determine the depth; samples of the bottom must be secured, and temperature and density observations made; and the dredge, beam-trawl, and tangle used to determine the character and abundance of the fishes and other life forms.

It is impracticable to enumerate in this connection the various investigations upon which the *Albatross* has been engaged. During the five years (1882 to 1887) when she was on the Atlantic coast she conducted important inquiries along the entire length of the coast from Maine to Florida, in the Caribbean Sea, Gulf of Mexico, off Newfoundland and Nova Scotia, and in the Bahamas.

In November, 1887, she left Hampton Roads for the Pacific, where she has ever



Cascades in Litnik Stream—Afognak Island, Alaska. Many Humpback Salmon are Seen Jumping in the Pool. One Large Fish is Struggling in the Falls

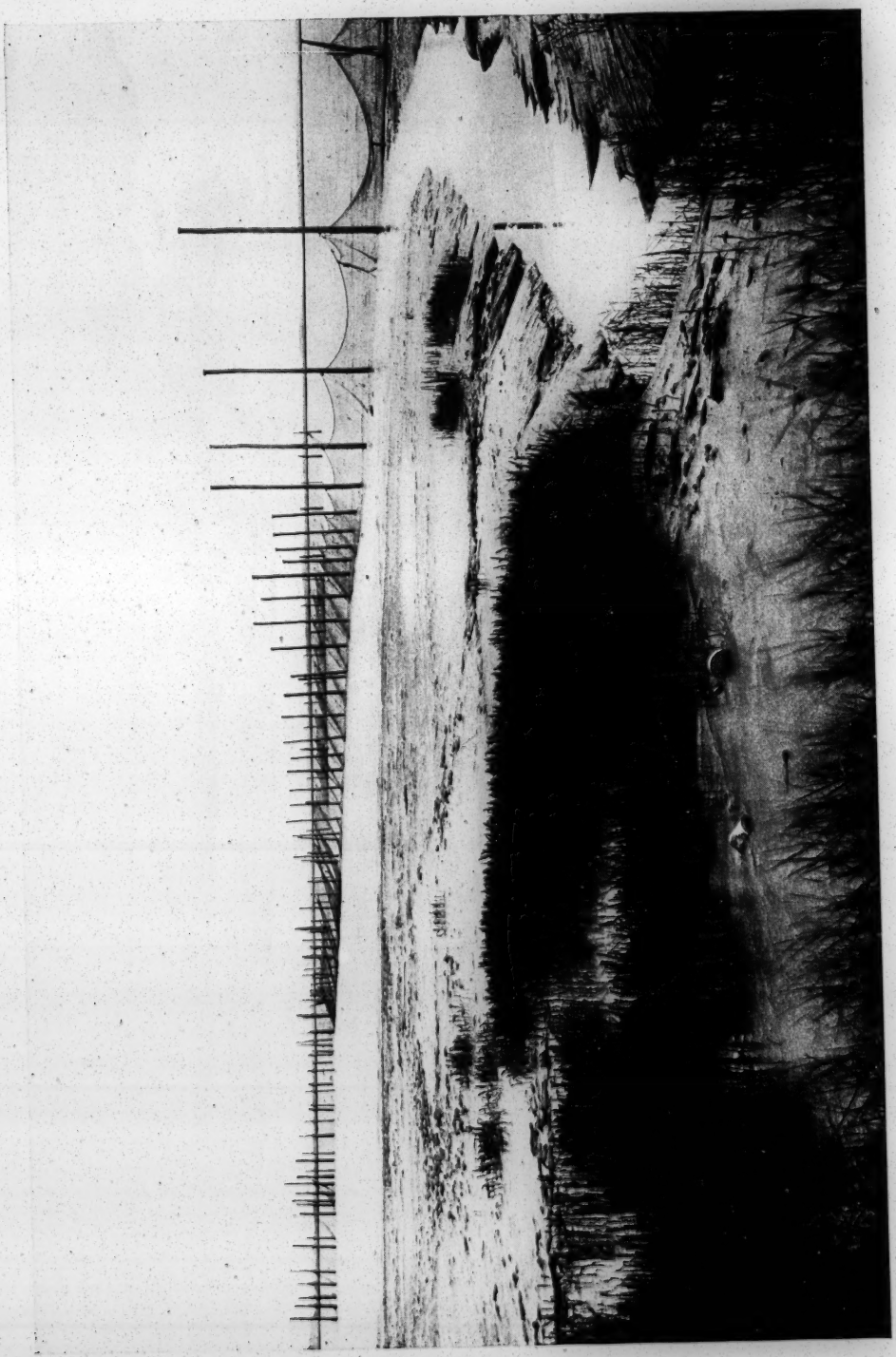
The salmon output of Alaska for 1903 is valued at $10,000,000, which exceeds by more than two and one-half million dollars the amount which Alaska cost us. If we add to the salmon the value of the cod, halibut, and other fisheries of Alaska, the total greatly exceeds all the other developed resources of Alaska combined.

A Salmon Ascending the Cascades of Litnik Stream. (See illustration on opposite page)

since remained. On her long voyage round the Horn many sounding and dredging stations were made and valuable collections obtained.

NOTED ACHIEVEMENTS OF THE ALBATROSS

During the sixteen years that the *Albatross* has been in the Pacific she has been as actively engaged in important work as the available funds would permit. Among the most notable investigations may be mentioned the development of important fishing grounds in the Gulf of California, on the coast of California off San Diego, Santa Barbara, and San Francisco, also off the Straits of Fuca and Vancouver Island; the discovery and development of rich cod and halibut grounds in the northern Pacific and Bering Sea; the study of the salmon fisheries of Alaska, and the fishes and other aquatic resources of the Hawaiian Islands. From 1891 to 1897 she was engaged for a portion of each year in investigations in connection with the various fur seal commissions. In the winter of 1891 and '92 she made, under the direction of the Secretary of the Navy, a survey for a cable from San Francisco to Honolulu. During the early months of 1891 and again in 1899



Salmon Trap Belonging to Alaska Packers' Association, Nushagok River

and 1900 the *Albatross* was put under the direction of Professor Alexander Agassiz, who carried on very extensive investigations off the Pacific coasts of Mexico, Central America, and South America, about the Galapagos Islands, and in the South Pacific. During last summer and fall she was placed in charge of the Alaska Salmon Commission for the study of the Alaska salmon fisheries; and now she is just entering on a comprehensive and thorough physical and biological survey of San Diego and Monterey bays.

THE GREATEST DEPTHS WHERE LIFE HAS BEEN FOUND

While carrying on her work the *Albatross* has made more than 10,000 soundings, and more than 4,000 dredgings, and has brought up from the bottom of the sea hundreds of tons of fishes and other animals and mud.

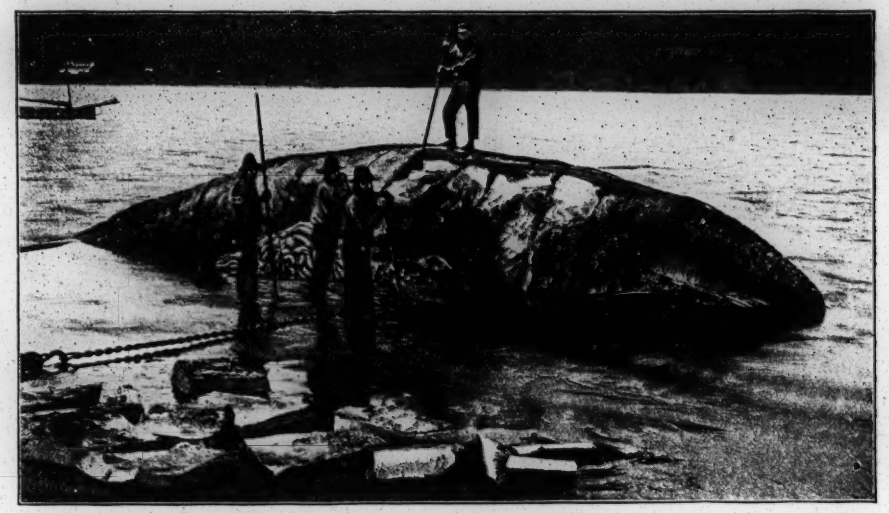
The greatest depth from which the *Albatross* has secured any life was 4,173 fathoms. This was in the South Pacific between Tonga and Ellice Islands. The dredge brought up silicious sponges, radiolarians, and brown volcanic mud. The greatest depth from which she has brought up fishes is 2,949 fathoms, or about 3⅓ miles. This was in the edge of the Gulf Stream off the coast of Virginia. The deepest sounding ever made by the *Albatross* was at Station 4010, near Guam, where the enormous depth of 4,813 fathoms, or nearly 5½ miles, was found.

The deepest sounding ever made by any vessel was by the U. S. S. *Nero* while on the Honolulu-Manila cable survey, with apparatus borrowed from the *Albatross*. When near Guam the *Nero* got 5,269 fathoms, or 31,614 feet, only 66 feet less than 6 miles. If Mount Everest, the highest mountain on earth, were set down in this hole, it would have above its summit a depth of 2,612 feet, or nearly half a mile of water.

The deep-sea collections of the *Albatross* from time to time have been assigned to specialists throughout the world for study and report. They have been marvelously rich in new and interesting species. About 100 new genera and more than 2,500 new species have been based on the collections of the *Albatross*. The results of the investigations of the *Albatross* have been published in more than 275 separate articles and reports which have appeared chiefly in the publications of the United States Fish Commission, the United States National Museum, and the Museum of Comparative Zoölogy.

The *Fish Hawk*, another steamer belonging to the Bureau, was built in 1880. This is a vessel of 484 tons, 156½ feet long over all, 27 feet beam, and was constructed expressly for the Fish Commission "to serve as a floating hatching-house for the production of shad, herring, striped bass, etc., and capable of being moved to any place where the breeding fish can be found." The *Fish Hawk* is also equipped for cod and mackerel hatching and for scientific investigation in the bays and sounds and other coastal waters. Every spring she is engaged in hatching shad and other species on the Atlantic coast at various stations from Florida to Maine. Besides this she has done a vast amount of dredging in connection with the survey and study of the oyster beds and fishing grounds of the Atlantic and Gulf coasts. In the winter of 1898 and '99 the *Fish Hawk* made an investigation of the aquatic resources of Porto Rico which yielded very important economic and scientific results.

The *Grampus*, the third of the larger vessels of the Bureau, was built in 1886. This is a two-masted schooner, 90 feet long over all, 22 feet 2 inches beam, and 83.3 tons displacement. The *Grampus* was constructed for a number of purposes. Being built with a live-well, fishes and other marine animals can be brought to the hatching or the



Removing Blubber from a Whale Beached on California Coast

This and the following views illustrate different phases of the American fishing and oil industries which are being studied by the Bureau of Fisheries. The illustration and the illustrations on pages 201, 202, 204 are from Charles H. Stevenson's admirable report, "Aquatic Products in Arts and Industries."

biological stations, thus affording an opportunity to study their habits and development. The vessel has also been useful in testing various fishing gear, such as the beam-trawl, in a commercial way, in following the schools of fishes and developing off-shore fishing grounds.

2. *Investigation of Interior Waters.*—One of the principal lines of work carried on by the Division of Scientific Inquiry is a study of the rivers and lakes of the United States with reference to the physical and biological characteristics of each.

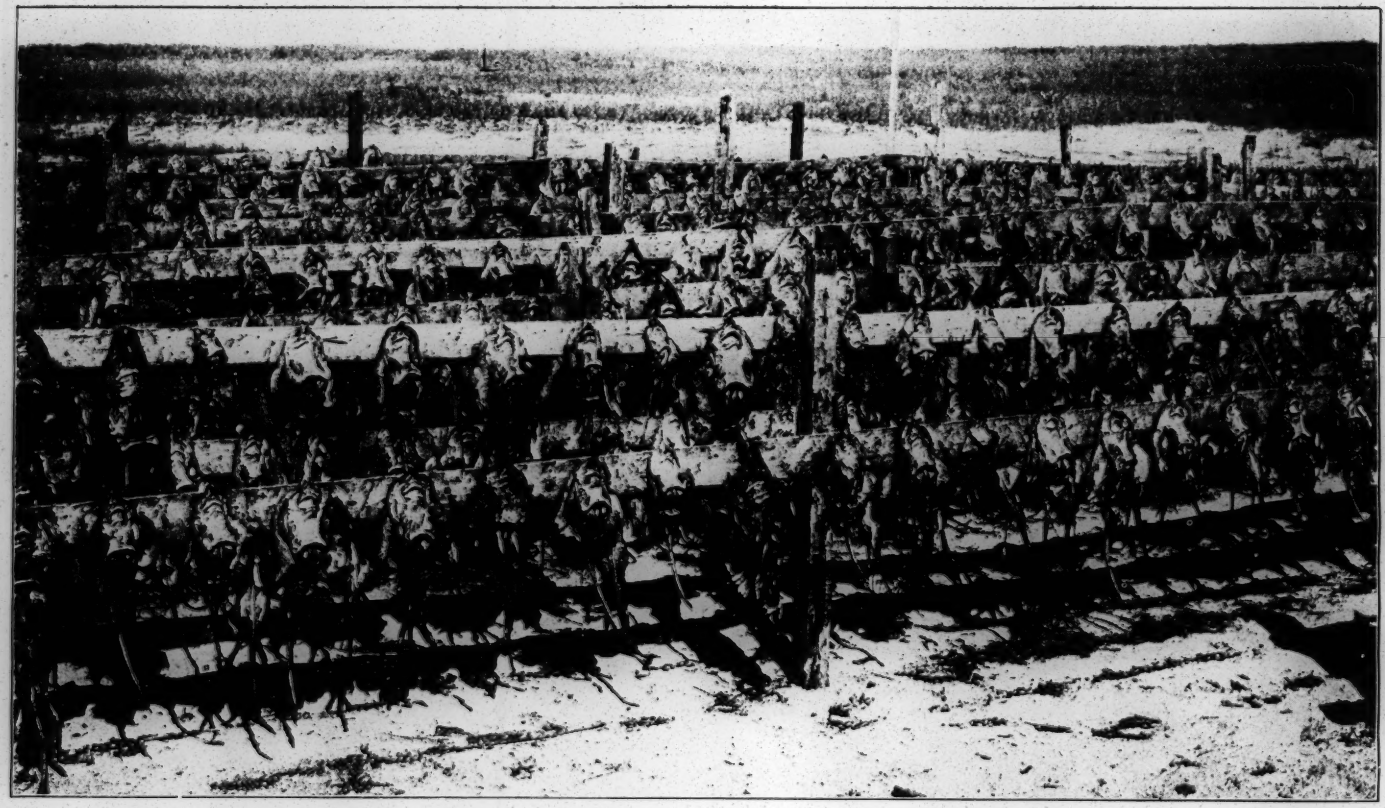
Very early in the history of the Fish Commission it became the custom of Senators and Representatives to ask the Commissioner to have plants of fish made in their state or district. The request was usually for a certain species of fish to be planted in a certain named stream or lake. The requests were always granted if possible, notwithstanding the fact that little or no information was at hand or could be supplied as to the fitness of the stream or lake for the particular species which it was proposed to introduce. Later it became evident that thousands of fish had been planted in waters to which they were not at all suited and in which they would never have been planted if the character of the water had been known.

In order that the fish-cultural work of the Commission might be more effective, the Division of Scientific Inquiry, then under the able direction of Mr Richard Rathbun, now Assistant Secretary of the Smithsonian Institution, undertook to supply as rapidly as possible accurate knowledge concerning the various lakes and river basins of the United States.

During the last twelve years parties from the Division of Scientific Inquiry have been in the field, usually only for a brief period each summer, but often for longer periods. These parties have

School of Black-fish Stranded on the Shore of Cape Cod, Massachusetts

The "black-fish" (*Globiocephalus melas*) occurs in many parts of the Atlantic Ocean. Individuals vary in length from 8 to 22 feet. They are captured by the sperm-whalers, and also at irregular intervals they are secured when stranded on the shore, especially in Cape Cod Bay, where they are attracted by squid, on which they feed. The animals are surrounded by boats and driven like cattle to the beaches, and are there stranded in endeavoring to escape. They are lanced to death, and when the tide falls the blubber and the oil-producing head matter are stripped off and conveyed to try-works on the shore, where the oil is extracted. The greatest catch of black-fish on Cape Cod was made in 1884. On November 17 of that year 1,500 were killed at Blackfish Creek, South Wellfleet, where they had been driven ashore. About a month later 500 more were slain in a great round-up in the bay. Since that time very few have been secured in the bay, nor have they been seen at sea in any such numbers as previous to the slaughter above noted.



Drying Skates for Manufacture into Fertilizer, Opposite Provincetown, Massachusetts

The principal aquatic products used for fertilizer are seaweeds, shells of mollusks and crustaceans, non-edible species of fish, especially the menhaden, and waste parts of edible species. At present the quantity of this fertilizer produced annually in the United States alone approximates 420,000 tons, worth $2,120,000. This is capable of very great increase, especially in the quantity of seaweeds and waste fish employed.

gathered data for each stream examined upon the following points: Character of the country through which it flows, volume of water which it carries, general character of the water as to clearness, purity, and temperature; the species of fishes, mollusks, reptiles, batrachians, and other animals inhabiting the stream or found about it, and the abundance, distribution, and habits of each; also the species of aquatic plants, their distribution, abundance, and their relation to the fishes of the same waters.

The primary and immediate objects of these investigations are to determine what species of fishes each stream already contains, what are the conditions favorable to their well-being, and whether the conditions, physical and biological, are favorable for the introduction of other species. Investigations of this kind have been carried on in about twenty different states—Maine, Vermont, New York, West Virginia, Indiana, Texas, Iowa, Minnesota, South Dakota, North Dakota, Wyoming, Montana, Idaho, Washington, Oregon, California, Florida, Tennessee, and Nebraska. As many of these investigations were made in response to resolutions of Congress calling upon the Bureau to determine the desirability of establishing fish-cultural stations in certain states, it can be seen that a wide area had to be covered, and that the investigations were necessarily hurried and incomplete. Occasionally, however, it has been possible to confine the observations for a longer period of time to a limited area, and more thorough work has resulted.

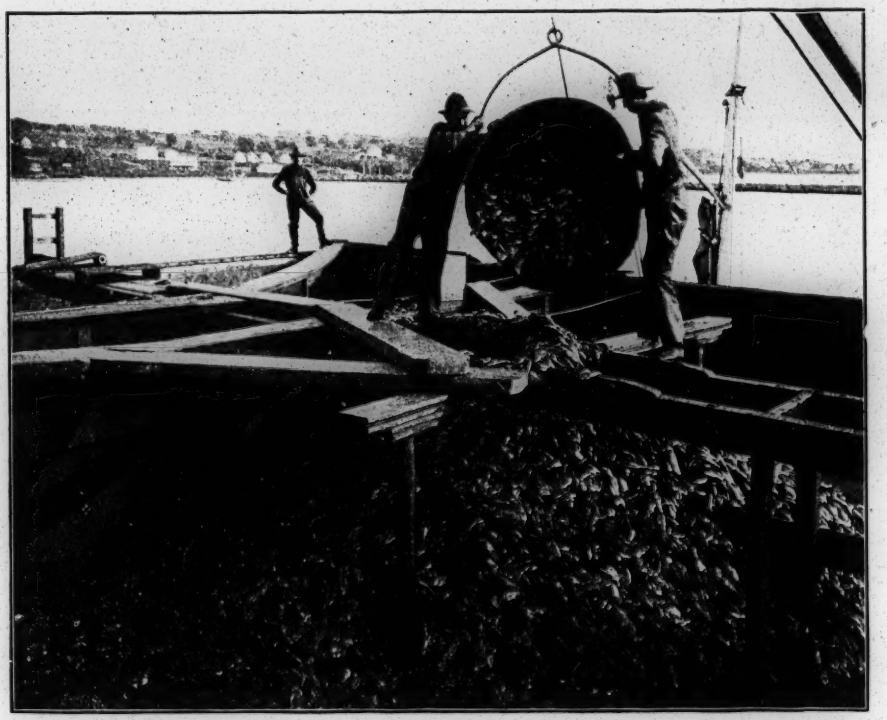
Not until 1899, however, was any such work undertaken under really favorable conditions. The Commissioner desired to secure knowledge regarding the ecology of the great multitude of small glacial lakes of the northern states. It was therefore decided to select a suitable lake and make such a study of it as would serve as a model for the investigation of all similar lakes. Lake Maxinkuckee, in northern Indiana, was known to meet all the requirements exceptionally well and it was selected.

There is not space to give in detail the outline of the investigations carried on at this lake. It must suffice to say that the lake was studied along many lines. A thorough physical survey was made and a very accurate map prepared. Thousands of soundings were taken and the hydrography of the lake carefully studied. Temperature observations were made and the chemical and physical characteristics of the water determined. The species of fishes, other animals, and plants in the lake were catalogued and careful studies of their habits, relations, and interrelations were carried on for one entire year, especial attention being paid to the food, enemies, and breeding habits of the food-fishes. More is now known of this lake, perhaps, than of any other lake in America, and more has been learned of the habits of the species inhabiting it than we know for any other region.

3. *Experiments in Oyster Culture.*—Another investigation which this Bureau is now conducting and which promises very great economic results pertains to the artificial feeding of oysters.

It has been observed that oysters grow much more slowly on some beds than on others; that in certain places they fail to fatten. These places were usually on overcrowded beds, and sometimes good results could be secured by transplanting or thinning out. Qualitative and quantitative study of the diatoms (which constitute the food of oysters) on beds where the oysters fatten well, and on other beds where they fatten poorly, showed that the number of diatoms per liter of water was very much greater in the former than in the latter.

It was therefore believed that if the supply of diatoms could be increased on the unproductive beds the oysters on them would grow and fatten. Experi-



Discharging Menhaden from Vessel by Means of Tubs

The taking of menhaden on the Atlantic coast of the United States for conversion into oil and fertilizer gives employment to thousands of men and to several million dollars of capital. The menhaden belongs to the *Clupeidæ* or herring family, and is about the size of the common herring of the New England coast, but somewhat deeper and more robust. It is not considered a food-fish and is rarely eaten, owing to the abundance of bones, although the flavor is not unpleasant. However, it is one of the most important of all of the species on the coast, being the principal source of bait during the summer, in addition to its use in the manufacture of oil and fertilizer. The menhaden occurs all along the Atlantic coast of the United States from Maine to Texas, and most abundantly between Cape Cod and Cape Henry, except that during certain years it seeks the coast of Maine in enormous quantities. It appears on the approach of warm weather, ranging from March and April in Chesapeake Bay to May and June on the Maine coast, and remains until late in autumn. Its bathymetrical range extends from the inland limits of salt water to the Gulf Stream, but probably 95 per cent of the catch is made within two miles of the coastal line. It is captured principally by means of purse seines, operated from steam vessels with carrying capacity for several hundred thousand fish. The annual catch averages 500,000,000 fish, amounting to 30 per cent of the total catch of fish in the United States. In 1902 it reached 900,000,000.

ments along these lines were recently inaugurated at Lynnhaven, Va., under the immediate direction of Dr H. F. Moore, of the Bureau. A small cove was selected where the bottom and the salinity of the water were favorable, but where diatoms were scarce. Commercial fertilizers of certain kinds were used to furnish food for the diatoms, and it was very soon found that the latter greatly increased in abundance, and lean oysters transferred to this cove fattened rapidly. Details of the process need not be given here, but it is believed that

the experiments will demonstrate the entire practicability of the artificial feeding and fattening of oysters on a commercial basis.

4. *Experiments in Sponge Culture.*— Still another interesting investigation now being carried on in Florida has for its object the discovery and development of methods by which the valuable sheepswool sponge may be cultivated artificially.

Spongers at Work

The only apparatus used is the sponge hook, a three-toothed curved hook attached to poles of varying lengths, according to the depth of water in which the sponger is working, and the sponge glass—a common water bucket with the bottom knocked out and a pane of window glass substituted. The latter is used for seeing below the surface when the water is disturbed by ripples.

The method which promises the most satisfactory results is that of using cuttings. Large sheepswool sponges are cut into small pieces, which are fastened to an insulated wire fixed in the water, so that the sponges are supported a few inches above the bottom. These small bits, placed at close intervals along the wire, soon heal and form an organic attachment to it, and very soon begin to grow. It is too soon to predict just what the results will be, but the indications are so far very encouraging, and it is believed that the time is not far distant when the sponge fisheries of Florida will be vastly increased in productiveness and value.

Another class of studies carried on by the division pertains to the parasitic enemies and diseases of fishes. These studies are in charge of Mr M. C. Marsh, pathologist of the Bureau. Knowledge of what are the principal diseases which attack our food-fishes, what the causes are, and how the attacks may be pre-

The Sponge Fleet and the Sponge Auction Wharf at Key West

There are two so-called sponge grounds: (1) the "key grounds," the waters of the "keys" extending in the shape of a crescent from Miami to Dry Tortugas, and (2) the "bay grounds," which are the most prolific, extending in the Gulf of Mexico from Johns Pass, a few miles north of the entrance to Tampa Bay, to St Mark's lighthouse, a distance of about 200 miles.

vented or cured will greatly increase the efficiency of fish-culture.

5. *Biological Stations.*—For the study of scientific and economic problems connected with aquatic life, the Bureau maintains, besides the laboratories at the central station here in Washington, two seaside biological stations—one at Woods Hole, Mass., the other at Beaufort, N. C. These stations are well equipped with aquariums, microscopes, reagents, and special apparatus, and investigators are invited to come and make use of the superior facilities offered for the study of marine life.

6. *Pacific Salmon.*—Among the most important investigations now being conducted by the Bureau are those pertaining to the life histories and propagation of the Pacific salmon. On our Pacific coast and in Alaska are found five species of salmon. These salmon spend most of their life in the sea, coming into freshwater streams and lakes only at spawning time. After spawning once they all die, both the males and females, none ever spawning a second time and none ever returning to the sea. This is true of each of the five species of Pacific salmon.

The Bureau has been propagating the Chinook and Blueback salmon for several years, and the efficiency of the work has recently been greatly increased as a result of investigations made by Mr Cloudsley Rutter, whose untimely death a few weeks ago is a severe loss to the Bureau and to science.

7. *Volunteer Assistants.*—As a result of the investigations carried on by this division, the Bureau is now in possession of a vast amount of information regarding many of our rivers and lakes, but in only a few cases can this knowledge be regarded as sufficiently full. The survey is now well systematized, and it is hoped it may be carried on after a definite plan which contemplates a thorough study of all the important streams and lakes in the United States.

Although but few of our waters have as yet been studied even with approximate thoroughness, nevertheless the inhabitants of the streams and lakes of the United States, particularly the fishes, are better known than those in any other country.

In the conduct of its scientific investigations the Bureau has been fortunate in having the volunteer assistance of many of the most active and most distinguished zoölogists in America, among whom may be mentioned Jordan, Agassiz, Gill, Forbes, Gilbert, Jenkins, Bumpus, Linton, Meek, and many others. These men have been glad to give their services, without any salary, to the Bureau for special investigations, their only desire being the advancement of knowledge in those branches of zoölogical science in which they are interested.

3. DIVISION OF FISH CULTURE

This important division has charge of all the fish-cultural operations of the Bureau. The assistant in charge has general direction of all hatching, rearing, and distributing stations and operations, and of all the railway cars, launches, and other vessels of the Bureau while engaged in hatching and distributing fishes and their eggs.

The first fish-cultural stations were mere makeshift affairs, with temporary buildings and moderate equipment, permitting change from place to place as occasion required. Later, as the advantages and disadvantages of different places came to be understood, permanent stations were established and the equipment improved. Later still, Congress began making appropriations for hatcheries to be located in certain specified states. The number has increased rapidly, until now the fish-cultural operations of the Bureau are carried on at 46 different stations, which are well distributed over the United States. There are stations in New England for the hatching

of Atlantic salmon, Sebago salmon, trout, codfish, flounders, and lobsters; on the Great Lakes for whitefish, lake trout, and wall-eyed pike; on the rivers of the Middle and South Atlantic States for shad; in the central and upper Mississippi Valley for trout and black bass; in the Gulf States for black bass and other pond species; at Bozeman, Montana, for grayling and various Salmonidæ, and on the Pacific coast for the Chinook and sockeye salmon and the steelhead trout.

The total number of species of fishes and other aquatic animals that are or have been propagated by the Bureau exceeds 100. With few exceptions, these are all exclusively American species, and the methods for their artificial propagation have been developed wholly in this country.

The output of the hatcheries has increased enormously, especially during the last six years. We no longer speak of hatching thousands of fry, but of millions and hundreds of millions. The number of eggs, fry, fingerlings, and adult fish distributed by the Bureau in 1902 aggregated one and one-half billions.

In distributing this enormous output the Bureau employs five cars, each built especially for this business and owned by the Bureau. Each of these cars is in charge of a car captain, who has the necessary assistants. Each car is equipped with tanks, in which the fish are carried, facilities for aërating the water and for keeping the water pure and cool. There is a small engine in each, adequate cooking facilities, sleeping berths like the upper berths in the standard Pullman, and an office for the captain. These cars are kept almost constantly employed, and travel all over the United States.

EXCELLENT RESULTS OF ARTIFICIAL PROPAGATION

The good results of the artificial propagation of food and game fishes by the federal government are no longer questioned by any one who is at all informed regarding such matters. Equally good results have not been obtained with all the species handled. That would be entirely too much to expect. With some species, as the sturgeon, the results so far are very unsatisfactory. With the Atlantic salmon we do not know whether the supply has been increased by artificial propagation or not, but with practically all the other species now propagated it is certain that excellent results have been secured. It is certain that the shad, whitefish, lake trout, and pike perch fisheries, each of vast importance, have not only been saved from entire depletion, but that they have been maintained, chiefly through artificial propagation, at a high degree of productiveness. That these fisheries are industries today, valued at nearly $3,000,000 annually, is due entirely to artificial propagation by the Bureau of Fisheries.

Important food- and game-fishes are now found in abundance in waters of the United States where they did not exist until planted there by the Bureau of Fisheries. Many examples might be cited, but a few will suffice.

Yellowstone Park.—Originally, the majority of the lakes and streams of Yellowstone Park were entirely without fish of any kind. In 1889 the government began making plants of various species of trout in the different barren waters; now trout are abundant in all these waters, and there are practically no restrictions on angling.

Lake Superior.—The steelhead trout, native only to our Pacific coast, has been introduced into streams tributary to Lake Superior. It has done well, and now thousands of dollars are spent in that region every year by anglers who go there to fish for steelhead trout.

The range of the black bass, yellow perch, crappie, brook trout, rainbow trout, Sebago salmon, cutthroat trout,

and many other species has been greatly extended, and commercial fishing, as well as very attractive angling for these species, is now found in many regions where none was previously known. Eighty per cent of the catch of commercial fishes in Colorado consists of introduced species.

The Carp.—This fish was introduced into this country in the early years of the Commission. It found a congenial home in our more sluggish waters, is now an abundant fish in many parts of the country, and is the object of an important fishery. The catch last year amounted to 17,160,873 pounds, valued at $407,633, an amount nearly equal to the total appropriation for carrying on the work of the Bureau of Fisheries for the current year. A fishery which adds annually that amount of food-stuff to the supply and puts half a million dollars into the pockets of the fishermen is not to be ignored.

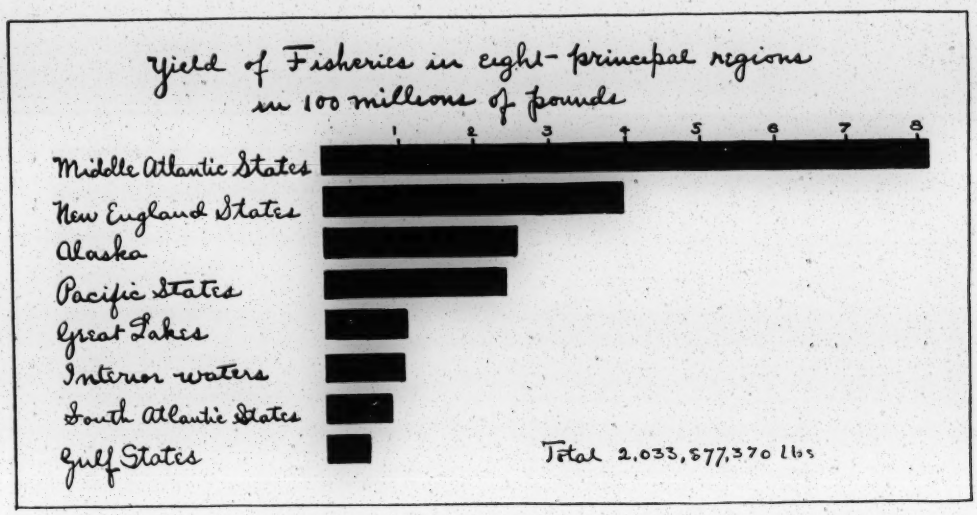
The fact that the introduction of the carp into this country has been severely criticised by anglers and others is of little moment. Not one of the criticisms of the carp has been proved and the majority of them have been shown to be without any basis in fact. The most persistently reiterated charge is that the carp eats the eggs and fry of the bass and other better fish. A sufficient reply to this is the fact that in the Illinois River, where the carp is more abundant than in any other American river, the black bass is now actually more abundant than it was ever known to be before the introduction of the carp. Instead of the carp feeding upon the bass, they furnish food to the bass. The carp brings more money to the fishermen of Illinois than all other fishes of the state combined.

Shad and Striped Bass.—A few years ago these two food-fishes were introduced into Pacific coast waters where neither was previously found. Both species thrived well, and now the catch on the coasts of California, Oregon, and Washington amounts annually to more than 2,500,000 pounds, valued at nearly $78,000. This is an absolute demonstration of the value of artificial propagation, for it is certain that every shad and every striped bass on the Pacific coast are descendants of fish planted there.

That proportionately greater results have followed the propagation of these species on the Atlantic coast is not questioned by any one familiar with the shad and striped bass fisheries.

Pacific Salmon Fisheries.—The salmon fisheries of the Columbia and Sacramento rivers have not only been saved by artificial propagation from absolute ruin, but have been built up to proportions never known before the days of artificial hatching. This fact is admitted by every cannery man and intelligent fisherman on those rivers. Those familiar with the Sacramento say that the run in 1903 was three times as great as ever before known; and the oldest and most intelligent men on the Columbia say that the run in that great river during the season just past was the greatest they ever saw. Government hatcheries on these two rivers for several years have been turning out many millions of fry in their waters.

The condition of the salmon fisheries of Puget Sound, Fraser River, and Alaska is in marked contrast. Little attention has been given to artificial propagation of salmon on Puget Sound, the Fraser River, or in Alaska, regions in which the salmon fisheries have been prosecuted no more assiduously than on the Columbia and Sacramento. The catch in Alaska has been kept up only through more persistent fishing and by utilizing the inferior species not previously considered fit to can. The season of 1903 on Fraser River and Puget Sound was the poorest in the history of the salmon fishery of that region. That the run of salmon has greatly increased



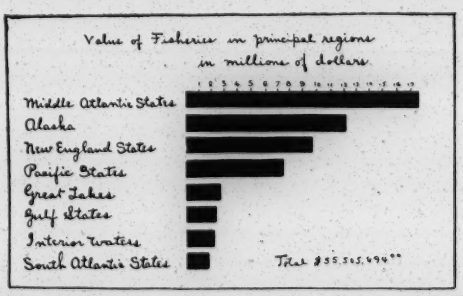
wherever attention has been given to artificial propagation and that it has greatly decreased in all other places are very significant facts, which establish beyond question the value of artificial propagation.

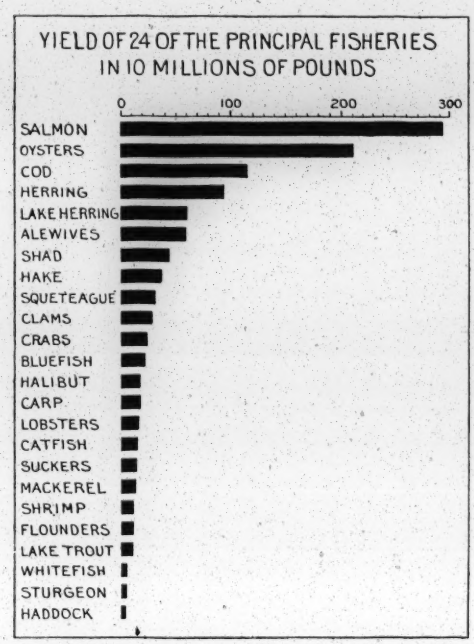
4. DIVISION OF STATISTICS AND METHODS OF THE FISHERIES

The Division of Statistics and Methods of the Fisheries is usually known as the Division of Fisheries. This division has to do with the commercial fisheries, both of the seas and the inland waters in their statistical and economic relations, the apparatus and methods of the fisheries, the methods of utilizing fishery products, the methods and conditions of the wholesale and retail trade in these products, the effects of fishery legislation and international fishery regulations, and ways and means by which the demand for aquatic products may be increased and the domestic and foreign market extended. In brief, this division has as its function the consideration of all the resources of the rivers and lakes and of the seas in all their economic relations.

The division acts as a bureau of information in the interests of the fishermen by acquainting the fishermen of one region with the improved apparatus and improved methods in use in other regions. In this manner the adoption of modern gear and methods is encouraged and the use of antiquated, destructive, or unlawful apparatus and methods is discouraged.

As has been well stated by Mr Charles H. Stevenson, of this division, the finding of the Halifax Convention of 1877, whereby our government was made to pay $5,500,000 to Canada on account of certain fishing privileges granted by the Treaty of Washington, "emphasized the necessity of having at hand accurate and comprehensive statistics of the fisheries and the impossibility of judicious legislation without them." It is claimed by those in position best to know the





facts that such an award would never have been made if our government had been in possession of complete and accurate statistics of the fisheries involved, such as the Bureau now possesses.

THE ENORMOUS VALUE OF THE UNITED STATES FISHERIES

The vast amount of nutritious, wholesome, and delicious food-stuff resulting from the fisheries of the United States is not generally realized. Some conception of it may be had from an examination of the diagrams here shown.

The total catch of food-fishes in the United States and Alaska, as shown by the last canvass, was 1,733,314,324 pounds, valued at $45,531,165. The number of men employed was 214,056 and the capital invested was $72,261,646. The salmon pack of Puget Sound alone in 1901 exceeded four and one-half millions of dollars, an amount more than four times as great as the entire silver output of the whole region drained by the Columbia River. The salmon output of Alaska for 1903 is valued at $10,000,000, which exceeds by more than two and one-half million dollars the amount which Alaska cost us; and if we add to the salmon the value of the cod, halibut, and other fisheries of Alaska, the total greatly exceeds all the other resources of Alaska combined.

In the early history of our country, when population was sparse, unaided nature could be depended upon to furnish much of the food which man needed, whether fruit, fish, flesh, or fowl. Deer and many other game animals were found in abundance both in the forests and on the plains. Game birds, including the wild turkey, grouse, quail, passenger pigeon, and many species of water fowl, existed in even greater abundance. Edible wild fruits and berries were found in great profusion, while the waters of the coasts, streams, and inland lakes teemed with delicious food-fishes of many kinds. The pioneers were literally able to live upon the natural products of the country. But population has vastly increased and, *pari passu*, the natural products of the country have decreased. Many of them have become extinct or practically so. We can no longer live upon the wild products of the country. In place of native game birds we must now depend upon the cultivated turkey and other domesticated fowl. In place of the vanishing game animals of forest and plain we now have vast numbers of cattle, sheep, and other domesticated animals. To supply the world's demand for food, fruits and grains, fowls and mammals must be cultivated; unaided nature can furnish but a mere trifle of the amount required. The resources of the sea and of the inland waters have not been so easily exhausted as those of the land. Aquatic animals were probably not only more abundant, but they were more difficult to get at, and it was more difficult for man to interfere with the conditions under which they live; but, though

longer delayed, depletion was inevitable. Population is increasing rapidly, and the demand for sea-food is increasing even at a greater ratio.

As a result of improved methods of canning, salting, smoking, freezing, or otherwise preserving, not only are the well-known food-fishes put upon the market in many new and attractive forms, thus greatly increasing the demand for them, but methods for the utilization of species hitherto regarded as useless are being discovered every year.

WILL OUR FISHING GROUNDS BECOME EXHAUSTED?

The marvelous increase in the facilities for distribution has widened the field and enormously increased the demand for the food products of the sea. Fresh oysters, clams, lobsters, shad, rockfish, and mackerel from the Atlantic coast; oysters, crabs, shrimps, and red snappers from the Gulf coast; and lake trout, pike perch, and whitefish from the Great Lakes, now find their way daily in their season into every state and territory of the Union; while the Pacific coast and Alaska send fresh halibut, steelhead trout, and royal Chinook salmon all over the United States and to Europe, the fish reaching their destination as fresh and sweet as when taken from the Columbia or the icy waters of Alaska.

To expect unaided Nature to keep pace with this ever-increasing demand for aquatic products is as unreasonable as it would be to expect the uncultivated land to meet the demand for grains and fruits and the butcher's food.

Cultivation of the coastal and interior waters is as possible and imperative as is cultivation of the land, and promises quite as rich returns. An acre of water can be made even more productive than an acre of land. On land, the producing area is a surface, but the total producing area of a body of water is many times the superficial area of its bottom. Dr Brooks of Johns Hopkins University, whom no one would ever charge with being a dreamer, says that the time will surely come when the oyster harvest of Chesapeake Bay each year will be fully equal to the total harvest of the last 50 years.

Oyster culture and fish culture are still in their infancy, and I am convinced that the time is not far distant when, through fish-cultural operations, the annual catch of each of many of our important food-fishes, particularly the shad on the Atlantic coast and the salmon on the Pacific coast and in Alaska, will be many times greater than it has been in the past.

Vice-Admiral Makaroff, whose tragic death on April 13 is much deplored, during recent years was one of the most prominent figures in the geographic world. His plan for reaching or getting near to the North Pole by means of his ice-breaker *Yermak* was original, and while the one test given was unsuccessful, the plan was not disproved. A summer's experience with the polar pack in 1901 showed that the vessel could crush a way successfully through one-year-old ice, but that it was helpless against older and thicker floes. The test showed that vessels of the *Yermak* type would be extremely useful in helping to explore the Arctic coast of Asia. It has also made many believe that while the type is not adapted for polar work north of Europe and Asia, it might prove more successful by the American, or Smith Sound route, where conditions are generally quite different.

THE GEOGRAPHY OF ALASKA*

ILLUSTRATED BY A NEW MAP

By Alfred H. Brooks

AMONG the many maps of Alaska which have appeared during the last half century, none has attempted to depict any but the horizontal relation. The accompanying illustration, therefore, marks a distinct advance in that it also expresses the vertical element or relief, by the use of 1,000-foot contours. The scale of 2,500,000 (about 40 miles to the inch) has been adopted to facilitate comparison with a map of the United States on the same scale, also published by the Geological Survey. The compilation begun three years ago was done under the direction of the late Mr R. U. Goode, chiefly by Mr E. C. Barnard.

This map, representing as it does a graphic synopsis of all that is known of the geography of Alaska, has great value, even though future surveys must show error in many of its details; for the general facts of the relief and drainage are known to be correctly indicated, and as surveys of this northern region progress, it will be possible to make adjustments and changes in new editions.

In the main, the map is based on the work of the Geological Survey parties during the years 1898–1903, but the shore features were furnished by the charts of the U. S. Coast and Geodetic Survey. That no material might be overlooked, all other Alaskan maps were consulted, including those of the Army, the Navy and Revenue Marine Service, and the Russian, British, and Canadian governments; and when exact cartographic data was lacking, the compiler had recourse to such information as had been collected by the Geological Survey parties from prospectors, traders, and natives. In every case the most reliable source of information has been used, yet the fact that the map is in part based upon accurate surveys and in part generalized from verbal descriptions and sketch maps gives to its different sections a very unequal value and suggests that it will be subject to many corrections in the future. However, the demand for a general map of Alaska which shall show the relief has been so great as to seem to justify the publication of one based only in part on accurate mensuration. A study of the diagram in the upper right-hand corner of the map will show, approximately, those parts in which the cartographic data was most reliable, the shaded spaces indicating the area in the interior of which surveys have been made. In all, about 150,000 square miles of the total area of 590,000 square miles have been surveyed, and at least two-thirds of the balance has been roughly mapped.

SURVEYS AND EXPLORATIONS

It would be impossible here even to outline the development of the geographic investigation of Alaska, which has been prosecuted intermittently since the early part of the eighteenth century, but with especial activity during the past decade. There are a few, however, of the more important surveys and explorations which should be mentioned.

In 1711 a Russian Cossack named Popof, who had been sent to the East Cape of Siberia to collect tribute from the natives, brought back an account of the islands which divide the Bering Straits, with rumors of a continent re-

* Published by permission of the Director, U. S. Geological Survey.

ported to lie beyond. This was the first intimation received by white men of what is now known as Alaska. The subsequent explorations seem to have taken place from three directions: the Russians reached it from the west, across Siberia and Bering Sea and Straits; the English came from the east, by way of the Mackenzie Valley; and navigators of various nationalities explored its coast, approaching it from the south by following the eastern shore of the Pacific. Among the most prominent of these early expeditions, which charted much of the coast line, were the Russians, led by Bering, Lütke, and Kotzebue; the English, led by Cook, Vancouver, Franklin, and Beechey; a few Spaniards; one Italian, Malaspina; and La Perouse, a Frenchman. These, together with many of lesser note, in the interval between Bering's first voyage (1728) and the middle of the eighteenth century, had obtained a general outline of the coast, but it remained for the Coast and Geodetic Survey to undertake its detailed charting after the transfer of the territory to the United States.

Previous to 1865, but little was known of the interior of Alaska, which was then called Russian America. The Russian traders had pushed their way 1,000 miles up the Yukon, had explored the lower stretches of the Kuskokwim and the Stikine, and had made an abortive attempt to explore the Copper River, which ended in the murder of the entire party by the natives. Following the routes marked out by such explorers as Franklin and Mackenzie, the Hudson Bay traders had reached the Mackenzie River, and in the middle of the nineteenth century crossed to the Yukon waters, where their two posts controlled the fur trade of the upper river. From the other direction the Russian traders had traversed northern Asia and arrived in North America by way of Bering Strait and the Aleutian Islands. Thus it was here in Alaska that the rival fur-trading interests came into competition, after encircling the globe.

In 1865 the Western Union Telegraph Company organized a survey of northwestern America, with a view to finding a route from the United States through Canadian territory and Russian America to Bering Strait, to connect by cable with a line crossing Siberia from Europe. The success of the Atlantic cable led to the abandonment of the project, but the results gained by the scientists and explorers of the expedition, of whom Dr Wm. H. Dall was the most prominent, have been of lasting importance. Those of geographic value are a map of the Yukon River and important additions to the knowledge of the Yukon delta, Seward Peninsula, and the Norton Bay region. It is interesting to note that the route which these first explorers selected was practically the same as that adopted by the telegraph lines which are now being constructed in Alaska and adjacent Canadian territory.

When Alaska first passed into the possession of the United States, in 1867, but little attempt was made to explore the interior. In 1869 Capt. R. W. Raymond, U. S. A., was sent up the Yukon to determine the approximate position of the international boundary and thus settle the conflicting interests of American and British traders. In 1883 Lieut. Frederick A. Schwatka, U. S. A., crossed the Chilkoot Pass and descended the Lewes and Yukon rivers to Bering Sea, making reconnaissance surveys en route. During the succeeding decade explorations in the interior were fostered by various branches of the government and by private enterprise, but only intermittently and not as the result of any definite plan. Perhaps the most notable expedition in the annals of Alaskan exploration is the one conducted in 1885 by Lieut. Henry T. Allen, now general and chief of the constabulary forces in the

Philippines. In spite of great difficulties and hardships, he ascended Copper River, crossed to the Tanana, and, following that stream to its mouth, extended his explorations for some 300 miles up the Koyukuk. During the years 1884 and 1885 Lieut. George M. Stoney, U.S.N., made extensive explorations in the drainage basins of the rivers tributary to Kotzebue Sound. Lieut. W. L. Howard, a member of this party, during the winter of 1886 crossed the region lying between the headwaters of the Kobuk and the Arctic Ocean. Meanwhile, in 1884, Lieut. John C. Cantwell and other officers of the Revenue Marine Service also made explorations in the Kotzebue Sound region.

The pioneer traders and prospectors have done much toward the exploration of Alaska, though the results of their many hazardous journeys have not always been available to the public. The first of these frontiersmen, who were traders rather than prospectors, came into the Yukon Basin via the Hudson Bay Company's routes from the valley of Mackenzie, probably early in the seventies. During the succeeding two decades they established trading posts at various points on the Yukon. A small steamer made one trip up the Yukon each summer, for the purpose of supplying these traders, to take the furs to St Michaels, whence they were shipped to San Francisco. There are few records of the explorations of these pioneers, but we know that Frank Densmore explored the Kuskokwim, Arthur Harper the Lower White and Lower Tanana, Jack McQuesten the Koyukuk, and Jack Dalton the White and Alsek basins. The knowledge these men obtained through their own efforts and by their intercourse with natives was in course of time embodied in the maps of the Alaskan region; and when the prospectors entered the region, about 1885, this information was of great use to them.

In 1889 the international boundary was located on the Porcupine and Yukon rivers by J. E. Turner and J. E. McGrath, of the Coast Survey, and was the first geodetic work done in the interior. Turner, in connection with this survey, led an expedition from his winter camp on the Porcupine along the 141st meridian to the Arctic Ocean.

Lieutenant Schwatka and Dr C. Willard Hayes, in 1891, made a journey from Fort Selkirk to the head of the White, and crossing to the Copper, followed the stream to its mouth. The same year E. J. Glave, one of Stanley's men, who lost his life in the Congo Basin, and Jack Dalton made their way westward from Pyramid Harbor to Kluane Lake. This expedition was important in that it was the first on which pack animals were used in Alaska.

The discovery of gold on the Yukon in 1886 resulted in the region gradually becoming better known, largely through the efforts of prospectors. At first the approach to the new gold diggings was made by the mouth of the river, but later a route across the Chilkoot Pass, which had been jealously guarded by the coast Indians, was opened up, and during the succeeding decade was annually used by not a few prospectors. The discovery of the phenomenally rich placer diggings in the Klondike in 1897 was followed by a great influx of gold-seekers during the succeeding two years. In the years 1897 and 1898 probably 60,000 people made their way to Alaska and the Yukon territory by various routes, but most of this travel was by the well-known coast passes from the head of Lynn Canal.

The public interest thus aroused led to a demand for more exact information, which resulted in appropriations being made for several government bureaus to undertake this work, and exploration and surveys were begun in 1898. The Geological Survey had six parties in the field the first year, and

has continued these surveys ever since. It is not possible to make mention here of all the surveys which have been carried on in Alaska by some thirty different parties. It will suffice to say that in six field seasons all but three of the larger rivers of Alaska have been mapped, as well as many large interstream areas. The results have been mostly published on a scale of 1:250,000, but it is planned to follow this reconnaissance mapping by detailed surveys, which have already been begun.

Among the notable explorations made by the Geological Survey was one by J. E. Spurr, who ascended the Yentna, the left fork of the Sushitna, and, portaging to Kuskokwim waters, descended the latter river to its mouth, and then returned to Cook Inlet by crossing the Alaskan Peninsula, completing a journey of some 1,400 miles. Another was by a party led by W. J. Peters, which left the coast at Lynn Canal, and, going westward along the northern base of the St Elias range, reached the headwaters of the White River, then extended its explorations to the head of the Tanana and crossed to the Yukon at Fortymile. In 1901 W. J. Peters and F. C. Schrader made a trip which included a journey the entire length of Alaska, from the southernmost limit to Point Barrow. During the winter they traveled to the Koyukuk with dog teams, thence ascended one of the north forks of that stream, crossed to a tributary of the Colville, and made their way to the Arctic Ocean. They then skirted the coast westward to Point Barrow and finally southward to Cape Lisburne, where they were so fortunate as to find a steamer. In the same year W. C. Mendenhall and D. L. Reaburn explored the headwaters of the Allen and Kobuk Rivers, and followed the latter to its mouth, at Kotzebue Sound.

In 1902 Brooks and Reaburn made a survey of the western front of the Alaskan range during a journey of 800 miles from Cook Inlet to the Yukon. Areal surveys have also been completed of the entire Seward Peninsula and of the Copper River basin.

The foregoing sketch will show the progress of Alaskan surveys from 1709 to the present day, and the accompanying map embodies the results of this mensuration.

GEOGRAPHIC FEATURES

It will be of interest to study Alaska with the aid of this new map, and to compare it, both as to position and to dimensions, with better-known parts of the earth's surface. This relief map also permits of a classification of Alaska's salient physiographic features to a better understanding of its topography.

An examination of a chart of the world will show that the latitude of Alaska corresponds approximately to that of the Scandinavian Peninsula. Point Barrow, the northernmost cape of Alaska, is in about the same latitude as North Cape. Dixon Entrance, which marks the southernmost point, is nearly on the same parallel as Copenhagen. Sitka, the capital of Alaska, is in the latitude of Edinburgh, in Scotland.

To consider the longitude, the meridian passing through the westernmost of the Aleutian Islands passes near the New Hebrides and through New Zealand. Cape Prince of Wales, the most westerly point of the mainland, is nearly as far west as the Samoan Islands.

Alaska stretches through 27 degrees of latitude and 54 of longitude. Its east-and-west dimension, measured to the extreme limit of the Aleutian Islands, is almost exactly equal to the distance from Savannah, on the Atlantic coast, to Los Angeles, on the Pacific. Its most northerly and southerly points are as far apart as the northern and southern boundaries of the United States.

Alaska, the northwestern extremity of the North American continent, forms in its main mass a peninsula nearly rect-

angular in outline, cut off from the continent by Mackenzie Bay on the north and the Gulf of Alaska on the south. South of it lies the Pacific Ocean. On the west it is bounded by Bering Sea and Bering Strait and west and north by the Arctic Ocean.

The territory is extended west and southwest by its two peninsulas of considerable size—the Seward Peninsula, which with the Chukchee Peninsula divides Bering Sea from the Arctic Ocean, and the Alaskan Peninsula, which, continued in its archipelagoes, the Aleutian Islands and Commander Islands, cuts off Bering Sea from the Pacific Ocean. The coast of Alaska is of two distinct topographic types. Northward from the Alaskan Peninsula shallow-water conditions usually prevail, the coast line is very regular, and the land slopes gently from the shore. Eastward and southward from the Alaskan Peninsula the shores are usually abrupt, with many embayments and islands. This Pacific Coast region is included in the glaciated area of Alaska, while along the western and northern coasts glaciation is either entirely absent or only of local character.

The Pacific Coast line forms a deep reëntrant angle, which is occupied by the Gulf of Alaska. It is bounded on the east by the Panhandle of the territory, usually called Southeastern Alaska, and on the west by the Alaskan Peninsula. It will be shown that the axes of the dominant mountain chains undergo, too, a marked change in direction, and are parallel to the crescent-like bend of the southern coast line. A study of the geology goes to show that this is the topographic reflection of an important structural feature.

A clear conception of the main features of the topography of Alaska can be obtained by comparing them with those of the western United States. A broad mountainous belt, called by Major Powell the Pacific Mountains, including the coast ranges of California, Oregon, and Washington, the Sierra Nevada, and the Cascade Mountains, extends along the western margin of the United States and is continued by other ranges northward into Canada. East of this lies the Great Basin or Central Plateau region, which also finds its counterpart in British Columbia to the north. The eastern limit of the Plateau region is marked by the Rocky Mountains, which again, like the western Pacific Mountains, extend into Canada. To the east of these the Great Plains extend northward to Arctic waters.

Dr George M. Dawson and others have shown that these four topographic provinces of the United States, which are fairly well defined throughout western Canada, find their continuation in similar geographic features in Alaska. The general trend of the highlands in Alaska, as in the United States and Canada, is parallel to the coast line. Attention has already been called to the great southwest bend of the Alaskan shore line near latitude 60°. The orographic features of the mainland experience a similar change in direction, continuing parallel to the shore line.

Alaska is thus divisible into the same four geographic provinces as those of western Canada and the United States. The lines of demarkation between these provinces are usually sharply drawn. Each is of a predominant topographic type, though each may be subject to many minor topographic subdivisions.

A mountainous belt skirting the Pacific coast of Alaska and British Columbia, extending inland from 50 to 200 miles, forms the westernmost of the four provinces, which, in conformity with Major Powell's classification, I will call the Pacific Mountain System. It properly includes the mountainous Alexander Archipelago and Aleutian Islands, and a number of other island groups which lie adjacent to the coast. The Pacific Mountains belt is made up of

four distinct ranges—the Coast, St Elias, Alaskan, and Aleutian. These are often separated by broad valleys or indentations of the coast line, and while the topography of the system is mainly rugged and mountainous, it includes several large basins, like that of the Copper River.

East and north of the Pacific Mountains is the Central Plateau region, limited on the north and east by the Rocky Mountains, corresponding with the Great Basin region of the western United States. The term plateau can only be assigned to a part of this province, and not even that by strictest usage. Its dominating topography is a gently rolling upland of low relief, compared with the mountain systems, in which the rivers have trenched broad channels. The interstream areas mark a former plateau surface, which the erosive agents have dissected. This plain slopes gently toward the axis of the basin, and the axis is tilted to the north and west. Its surface is interrupted by a number of mountains and mountain groups, which rise above the general level. Within this belt are also a number of lowland areas of considerable extent, which lie below the upland surface. Among these the flat of the middle Yukon is notable. The lowlands which extend along Bering Sea adjacent to the Kuskokwim and Yukon rivers are included in this province.

To the east and north is a broad mountain system, but little explored, which forms the third of the geographic provinces. It is, as has been shown, the northern extension of the Rockies. These, like the Pacific Mountains, also undergo a marked change in direction. Trending northwestward from the United States and Canada, they swing to the southwest at the Arctic shore, which they touch again north of Bering Strait. The system is represented in Alaska by the Endicott Mountains, and probably by several other ranges as yet unsurveyed.

The fourth province is that of the plains lying east of the Rockies, which in Alaska is represented by the Arctic Slope region, lying between the western extension of the Rockies and the Arctic Ocean. This province, like that of the western United States, is really a slightly elevated plateau, dissected and more or less rolling, which slopes to the north from the foothills of the Rocky Mountains. A featureless coastal plain, of varying width, separates the northern boundary of the plateau, which is marked by a scarp, from the Arctic Ocean.

About one-fifth of the drainage of Alaska is toward the Pacific Ocean, nearly one-half toward the Bering Sea, and the rest toward the Arctic Ocean.

The map shows the Yukon to be the master stream, and the outlines of its basin correspond in a general way with the boundaries of the Central Plateau province. The headwaters of this mighty river, the fifth in size of the North American continent, lie in British Columbia far to the southeast of Alaska, where they fight for mastery on one hand, with the water-courses flowing into the Pacific, and on the other with those belonging to the Mackenzie drainage basin, flowing into the Arctic Ocean. The general course of the Upper Yukon and its tributaries is northwest as far as the Arctic Circle. It then makes a great southwest bend and pours its great volume of muddy waters into Bering Sea nearly 3,000 miles from the source of its longest tributaries. The valley of the Yukon occupies the medial line of the plateau province, and with it makes the same great bend to the southwest parallel to the swing of the two mountain systems to the north and south. The relief, which is measured by the altitude of the remnants of the plateau above the floor of the valley, is greatest near the international boundary and decreases both above and below. A narrow valley characterizes the Upper Yukon proper, which broadens out at

the so-called Yukon Flats, near the big bend, and contracts again below in the Ramparts, and then broadens out below the mouth of the Tanana.

The northern and eastern limits of the catchment basin are generally defined by the crest line of the inland frontal ranges of the Rocky Mountain system, but this does not always hold true, for the Peel River, a tributary of the Mackenzie, has its source west of the Rockies. On the other hand, the Macmillan River finds outlet in the Yukon drainage after traversing one of the ranges of the Rocky Mountain system. The southern and eastern divide of the Yukon basin is even of greater irregularity. On one hand, some of its tributaries find their sources to the south of the ranges of the Pacific Mountain system, and on the other a number of large rivers emptying into the Pacific have their headwaters inland of this barrier.

The Yukon River forms the great natural highway of Alaska. In summer 3,000 miles or more of navigable waters are found within its basin, and in winter the frozen surface of the river affords a route of travel for dog teams. It was along the rivers that the pioneer could best journey, for on his crude rafts or boats, built of the timber which grew on the banks, he could transport necessary supplies, and later the steamboat succeeded to that propelled by hand.

The Kuskokwim, flowing into Bering Sea, is second only to the Yukon among Alaskan rivers, and includes probably upward of 1,000 miles of waters which are navigable for steamers. Its basin lies west of the Alaskan range and entirely within the plateau province.

The Pacific drainage embraces two classes of rivers: First, those whose catchment basins lie entirely within the coastal zone of mountains, and, second, those whose courses reach into the interior region and traverse the mountains on their way to the sea. Of the first the Sushitna and Copper, and of the second the Alsek, Taku, and Stikine are the most prominent examples.

The Arctic Ocean receives the waters of a small part of the plateau provinces through short rivers draining the northern part of the Seward Peninsula and some larger ones flowing into Kotzebue Sound. Much of the larger part of the Arctic drainage consists of that received from the interior valleys of the Rocky Mountain ranges and from their northern slopes. Under the former are comprised the drainage basins of the Noatak and the Kobuk, both streams including navigable waters which are bounded both north and south by the mountains of the northern system. The second class of waterways includes the northerly flowing streams which receive the drainage from the seaward slope of the Rockies. The Colville, the largest of these streams, properly belongs to both classes, for its source lies well within the front ranges, which it traverses in a narrow valley, and it also receives a large amount of drainage from the northern slope of the Rocky Mountains.

"Commercial Japan in 1904," a monograph just issued by the Bureau of Statistics, shows that the trade relations between the United States and Japan in recent years have grown with greater rapidity than between Japan and any other nation. Japan sends us mainly what is not grown in this country—raw silk, tea, rice, matting, bamboo, and lacquered ware, etc.—while we in return ship her annually great quantities of raw cotton, oil, iron and steel manufactures, breadstuffs and provisions, tobacco, scientific instruments, etc.

TERMINATION LAND

THE WESTERN END OF THE ANTARCTIC CONTINENT DISCOVERED BY THE AMERICAN WILKES

*In the deserved congratulations that are being showered on Captain Scott, of the British Antarctic Expedition; Captain Drygalski of the German; Captain Bruce of the Scottish, and Captain Nordenskjold of the Swedish, for their gallant achievements in the Far South, the world is apt to forget that the American naval commander Wilkes discovered in 1840, and first announced to the world the antarctic continent, called "East Antarctica," of which Wilkes Land is a part, and that another American, Captain Palmer, was the pioneer explorer of the opposite side of the antarctic region known as "West Antarctica." The story of the bold ventures of these Americans in puny sailing vessels is told by Mr Edwin Swift Balch in his "Antarctica," the clearest and most accurate account of south polar exploration that has been published.**

ON the 17th of February, 1840, Lieut. Charles Wilkes, U. S. N., at the most westerly point of his memorable cruise which first revealed to the world the existence of a south polar continent, saw appearances of land to the southwest. It was only another point of the continental shore along which he had already sailed for some fifteen hundred miles, and all he says of it is the following sentence:† "On the 17th, about 10 a. m., we discovered the barrier extending in a line ahead, and running north and south as far as the eye could reach. Appearances of land were also seen to the southwest, and its trending seemed to be to the northwest. . . . We were now in longitude 97° 37′ E., and latitude 64° 01′ S." Wilkes charted this land as extending from about latitudes 63° 30′ south to 65° south, and from about longitudes 95° west to 97° west, and he gave it the name of Termination Land.

Just recently Dr Erich von Drygalski published a paper and chart ‡ giving the results of the cruise of the *Gauss* to the Antarctic. On his map Dr von Drygalski charts a coast line, "Hohes Eisbedecktes Land," in about 66° south latitude and 93° west longitude, as discovered by himself. Entirely north of 65° south latitude and entirely east of 95° west longitude he places the words "Termination Land?" In his paper, page 23, Dr von Drygalski says: "Als Stütze dieser Annahme galt ein von Wilkes als Anschein von Land bezeichnete und mit dem Namen Termination Land belegte sichtung zwischen 95° und 96° Ö. L. v. Gr. und zwischen 64° und 65° S. B., welche jedoch, wie wir heute annehmen müssen, auf Taüschung beruht hat." And at page 26 he writes: "Nach zwei vergeblichen Versuchen, die uns nur über das Nichtvorhandensein von Termination Land kunde brachten." In other words, Dr von Drygalski coolly proposes to throw out Admiral Wilkes' discoveries entirely in order to take all the credit to himself.

But a comparison of Admiral Wilkes' chart with Dr von Drygalski's chart shows that the latter's "Hohes Eisbedecktes Land" can be nothing but the west coast of Termination Land; for if on Wilkes' chart we draw a line due southwest from the position of the *Vincennes* on the 17th, this line will go through the center of Termination Land; and if on Drygalski's chart we draw a similar line from the position which he

* Antarctica. E. S Balch. Philadelphia: Allen, Lane & Scott. 1902. $2.50 *net.*
† Narrative of the United States Exploring Expedition, Philadelphia, 1845, vol. 2, p. 327.
‡ Zeitschrift der Gesellschaft für Erdkundzu Berlin, 1904, No. 1.

gives of the *Vincennes* on the 17th, this line will go straight to the "Hohes Eisbedecktes Land." The direction tallies exactly. Now, as to distance, the western coast of the "Hohes Eisbedecktes Land," the one which Dr von Drygalski saw, is about 150 miles from the position of Wilkes on the 17th, and as this land must have some eastward extension and an eastern coast, it is obvious that this eastern side can not be very far from where Wilkes placed Termination Land. Besides, this "eisbedecktes" is also "hohes" land; that is, it is a high, mountainous land, and therefore it must be visible at a long distance. Sir James Clarke Ross states that he sighted Victoria Land at over one hundred miles distance by the land blink, and Wilkes was certainly as near as that to the eastern coast of Termination Land.

Thanks to the voyage of the *Gauss*, therefore, the world now knows positively that Termination Land exists, perhaps a few miles more to the west, but otherwise just about where Admiral Wilkes charted it; and, far from discrediting Admiral Wilkes, the observations of Dr von Drygalski simply show once more what a remarkably acute and accurate geographical observer Admiral Wilkes was.

EDWIN SWIFT BALCH.

LESSONS FROM JAPAN

ONE of the assignments of David G. Fairchild, agricultural explorer of the Department of Agriculture, during 1903 was to visit Japan with the third Barbour Lathrop Expedition to see if some agricultural lessons might not be learned from a people who are such ingenious farmers that their 45,000,000 people live almost entirely on the productions of a cultivated area about one-third the area of Illinois. As a result of this visit, two interesting reports by Mr Fairchild have been published by the Department.* A number of new plants of commercial value have also been introduced, which promise a material addition to the wealth of our country and new crops of value for the South—among them, mitsumata, a Japanese paper plant, and new varieties of bamboo.

From the bark of trees and shrubs the Japanese make scores of papers, which are far ahead of ours.

* "Japanese Bamboos and their Introduction into America," and "Three new Plant Introductions from Japan" by David G. Fairchild. Bulls. 43 and 42, Bur. Plant Ind. Dep't of Agric.

The walls of the Japanese houses are wooden frames covered with thin paper, which keeps out the wind but lets in the light, and when one compares these paper-walled "doll houses" with the gloomy bamboo cabins of the inhabitants of the island of Java or the small-windowed huts of our forefathers, one realizes that, without glass and in a rainy climate, these ingenious people have solved in a remarkable way the problem of lighting their dwellings and, at least in a measure, of keeping out the cold.

Their oiled papers are astonishingly cheap and durable. As a cover for his load of tea when a rainstorm overtakes him, the Japanese farmer spreads over it a tough, pliable cover of oiled paper, which is almost as impervious as tarpaulin and as light as gossamer. He has doubtless carried this cover for years, neatly packed away somewhere about his cart. The "rikisha" coolies in the large cities wear rain mantles of this oiled paper, which cost less than 18 cents and last for a year or more with constant use.

An oiled tissue paper, which is as tough as writing paper, can be had at the stationers for wrapping up delicate articles.

In the tea factories, the piles of paper sacks filled with tea are made of shibu gami. It is said that these tanned sacks keep the tea in better condition than any other sort, and that they last with careful use for many years. Grain and meal sacks are almost always made of this same paper in Japan, for it is not easily penetrated by weevils and other insects.

But perhaps the most remarkable of all the papers which find a common use in the Japanese household are the leather papers of which the tobacco pouches and pipe cases are made. They are almost as tough as French kid, so translucent that one can nearly see through them, and as pliable and soft as calfskin. These tobacco pouches quite change one's notions of the characteristics of paper, for the material of which they are made is as thick as cardboard, but as flexible as kid.

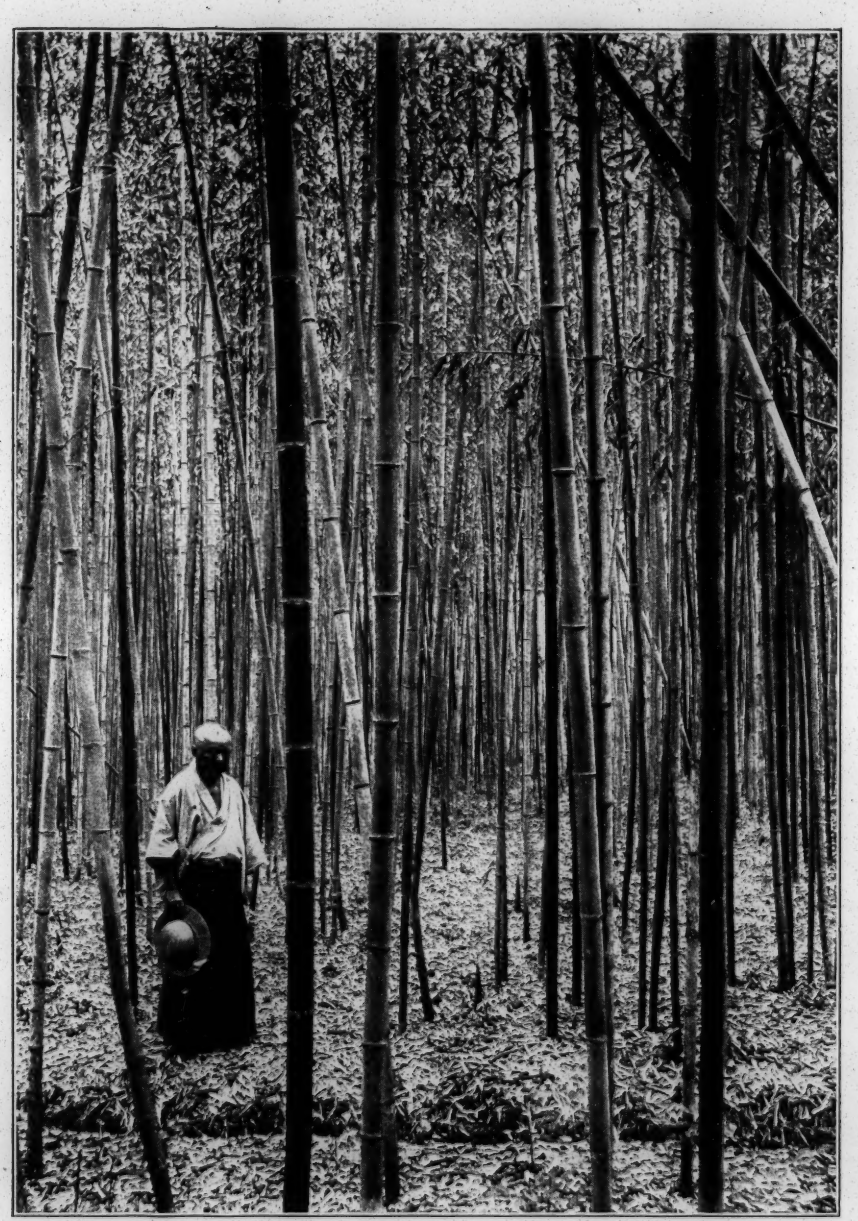
The use of paper napkins and handkerchiefs, umbrellas, and lanterns is as much a part of home life in Japan as the use of cheap tin articles is in America. But the reason for this remarkable use of paper articles does not lie wholly in the absence of cheap skins, though it is true that few domesticated leather-producing animals exist in Japan. The quality of the papers themselves makes them suitable, as ours are not, to these various purposes.

These Japanese bast papers are made from the inner bark of shrubs or small trees, while the papers of Europe and America are made either from wood pulp, the macerated stems of wild grasses, or the cotton and linen rags of the ash barrels. It is not a pleasant thought that the brilliant white note paper which your hand rests upon may have in it the fibers from the filthy garment of some Egyptian fellah after it has passed through all the stages of decay until it is saved by a ragpicker from the gutter of an Egyptian town; and yet it is a fact that hundreds of tons of Egyptian rags are exported every year into America to supply our paper mills. At Mannheim on the Rhine the American importers have their ragpicking houses, where the rags are collected from all over Europe, the disease-infected Levant not excepted, and where women and children, too poor to earn a better living, work day after day, with wet sponges tied over their mouths, sorting these filthy scraps for shipment to New York. Our best papers are made of these rags and our common ones of wood pulp, which is obtained by grinding and macerating huge blocks from some of our soft-wooded forest trees. The bast papers, therefore, are a creation of the Orient and are more nearly related to the South Sea Island tapa than to any of our products.

To the fact that they are made from bark they owe their peculiar character. They are as a rule softer, silkier, tougher, and lighter than our papers. If wet, they lose their strength, like tissue paper, but on drying regain it. They are usually absorbent, and for this reason were considered in the olden days as very valuable in surgery.

THE WONDERFUL BAMBOO

The word bamboo suggests to most Americans a faithful fishing rod or a dainty fan. To the Japanese and Chinese, who are the most practical agriculturists in the world, and to the natives of tropical India and the Malay archipelago, it is as indispensable as the white pine to the American farmer. They are not only dependent upon it for much of their building material, but make their ropes, mats, kitchen utensils, and innumerable other articles out of it, and at the same time consider it among the most nutritious of their vegetables. Varieties of bamboo are found



A Well-kept Forest of Timber Bamboo (*Phyllostachys quilioi*)

A bamboo stem, or culm, attains its full height—40, 60, or 100 feet—in a single season. It is allowed to stand for 3 or 4 years before cutting in order that it may harden. The shining stem is hollow and is divided into joints or knots by the crossing of the vascular bundles of fibers. There are many varieties of the bamboo plant, from the species which is woven into mats to the tall bamboo tree which the Chinaman uses for the mast of his large boat. One variety is cultivated as a vegetable, and the young shoots eaten like asparagus, or they may be salted, pickled, or preserved.

The rapidity of growth of the bamboo is perhaps its most wonderful characteristic. There are actual records of a bamboo growing 3 feet in a single day, or at the rate of 1½ inches an hour. The shoot in this picture is 5 feet high, and twelve days old.

everywhere in Japan, even where there are heavy falls of snow in winter. It is a popular misconception that bamboos grow only in the Tropics. Japan is a land of bamboos, and yet where these plants grow it is not so warm in winter as it is in California. In regions where the snows are so heavy that they often break down the young stems and where the thermometer drops to 15° F. below the freezing point, the largest of the Japanese species grows and forms large groves. Some of these varieties could be grown commercially in the United States.

The bamboo groves of Japan are not only one of the most striking features of its landscapes but one of its most profitable plant cultures. The largest well-kept groves in the world, except perhaps those of Burma, are growing in the central provinces, and some of these are several square miles in area. These groves pay the owners good interest, often $50 gold per acre annually; Japan exports 10,000,000 fishing rods alone, the larger share of which come to the United States. There are many bamboos scattered throughout the United States in botanical gardens, where they are cultivated for ornamentation. There are also some beautiful groves of imported bamboo in California, but no serious attempt has yet been made to grow varieties having commercial value.

"Forest Fires in the Adirondacks in 1903," by H. M. Suter, shows that more than 600,000 acres of timberland were burned over in northern New York between April 20 and June, 1903. About $175,000 was spent in fighting the fires, which nevertheless were finally extinguished only by the help of heavy rains. The total direct loss was approximately $3,500,000. No less serious, though incapable of money valuation, is the indirect loss due to the destruction of young growth which was to form the future forest. To this must be added the injury to the forest soil caused by the burning out of the vegetable matter indispensable to healthy tree growth. The unprecedented damage was due to the long drought in April and May, which had so dried the forests that the fires swept through with fearful fury.

The report is convincing evidence of the necessity of establishing an Adirondack national reserve, if we would preserve the beauty of this region. The report is published by the Bureau of Forestry, and contains a large map of the region devastated.

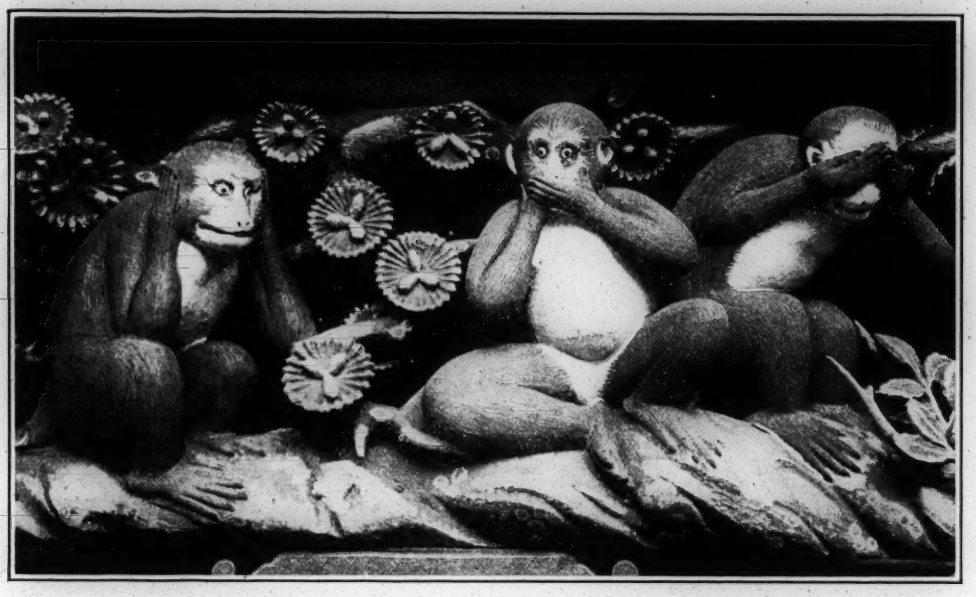


Photo from Alexander Graham Bell. Copyright, 1904, by the National Geographic Magazine

This Group of Monkeys Represent a Favorite Maxim of the Japanese, "Hear No Evil, See No Evil, Speak No Evil"

It is a wood carving on a door of the stable of one of the sacred horses at Nikko

INOCULATING THE GROUND

TO inoculate sterile ground and make it bring forth fruit in abundance is one of the latest achievements of American science. Some of man's most dread diseases—smallpox, diphtheria, plague, rabies—have been vanquished by inoculation, and now inoculation is to cure soil that has been worn out and make it fertile and productive again.

The germs that bring fertility are mailed by the Department of Agriculture in a small package like a yeast cake. The cake contains millions of dried germs. The farmer who receives the cake drops it into a barrel of clean water; the germs are revived and soon turn the water to a milky white. Seeds of clover, peas, alfalfa, or other leguminous plants that are then soaked in this milky preparation are endowed with marvelous strength. Land on which, for instance, the farmer with constant toil had obtained alfalfa only a few inches high, when planted with these inoculated seeds will produce alfalfa several feet high and so rich that the farmer does not recognize his crop.

It has been long known that repeated crops of wheat and grain gradually exhaust the nitrogen in the soil. Now, as all plants must have nitrogen, which in normal condition they absorb through their roots, this constant drain of nitrogen from the soil has so alarmed some persons that they have predicted a "nitrogen famine" to occur in 40 or 50 years, and they have very graphically

A Field of Vetch, Showing the Effect of Inoculation

The plat on the left was not inoculated, while that on the right was inoculated.

Even more startling than this picture is a comparison of the figures of yield of uninoculated and inoculated plots. Two patches of hairy vetch grown side by side under precisely the same conditions yielded crops as follows: Uninoculated patch, 581 pounds; inoculated patch, 4,501 pounds. Crimson clover under similar conditions yielded, uninoculated, 372 pounds; inoculated, 6,292 pounds. The difference in the amount of nitrogen obtained from the two crops was: hairy vetch, uninoculated, 7 pounds; hairy vetch, inoculated, 105.5 pounds; crimson clover, uninoculated, 4.3 pounds; crimson clover, inoculated, 143.7 pounds.

portrayed the possibilities of such a catastrophe. This view of the situation is greatly exaggerated, but the fact remains, nevertheless, that the main reason of once fertile lands becoming unproductive is loss of nitrogen in the soil.

The difficulty has been to get the nitrogen back into the ground. Fertilizers are expensive and not satisfactory; but there is an inexhaustible supply of free nitrogen in the air if it could be captured. The problem of how to utilize this free nitrogen has now been solved.

It was discovered some time ago that leguminous plants—clover, alfalfa, peas, etc.—were able to put back nitrogen into the soil and thus fertilize it. This is the reason why a wheatfield after a crop of alfalfa will yield a much heavier harvest. The plants absorb the free nitrogen by means of bacteria-tubercles growing on their roots, the tubercles varying

Tubercles of Velvet Bean Produced by Inoculation (Natural size)

The peculiar clusters on the roots are formed by innumerable minute bacteria. They absorb the free nitrogen in the air and put it back into the soil

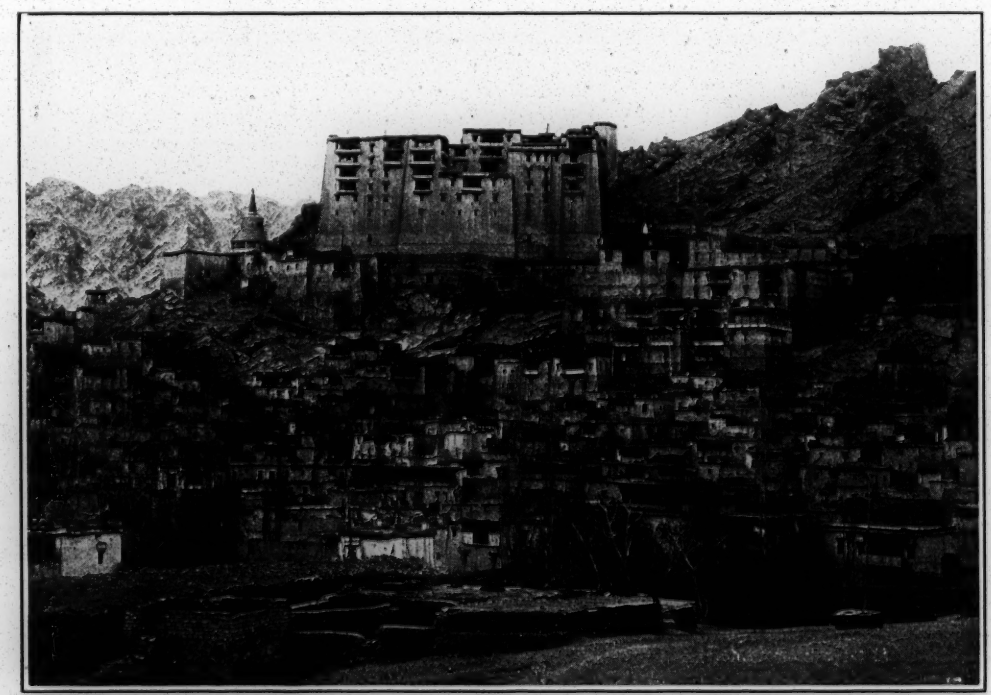
A fair average of the number of pounds of nitrogen added per acre to soil by leguminous crops is about 200 pounds, which, of course, is in addition to the large amount of nitrogen removed in the leguminous crop. This is what makes it so advisable to include a legume in any crop rotation, as the following crop gets the benefit of all the nitrogen left in the soil. The following list will give some idea of the gain in crops grown after legumes as compared with those grown upon the same kind of soil with fertilizers not containing nitrogen :

Cotton gained	372 pounds per acre	Oats	35.2 bushels
Potatoes	34.4 bushels	Wheat	8.3 bushels

in size from a pin-head, in the case of clover, to large clusters. Clover and beans possessing these tubercles will flourish in quartz sand after it has been heated to a red heat in order to drive out all nitrogen, while these plants without tubercles will not grow unless there is some nitrate in the soil. It was thus seen that if plants could be artificially presented with bacteria tubercles the plants would flourish in the poorest and thinnest soil.

The nitrogen-fixing bacteria in the tubercles were separated several years ago in Germany, but it remained for an American, Dr George T. Moore, of the Office of Pathological and Physiological Investigations of the Department of Agriculture, to devise a method by which these bacteria might be cultivated artificially in such form that their nitrogen-fixing power should be increased and be permanent and not evaporate. Great quantities of these germs are now being cultivated by the Department. Enough germs are sent in each little package to inoculate seeds for one or four acres. Each cake costs the government about two cents to manufacture, less than a cent an acre. Dr Moore's process has been patented by him, and has been by him generously deeded to the American people.

It must be clearly understood, however, that only seeds of leguminous plants—peas, alfalfa, beans, etc.—can be benefited by the nitrogen-fixing bacteria. Where the soil is rich and fertile, the crop is not appreciably increased by the use of the inoculating bacteria, but where the soil is poor, the harvest is increased many times.



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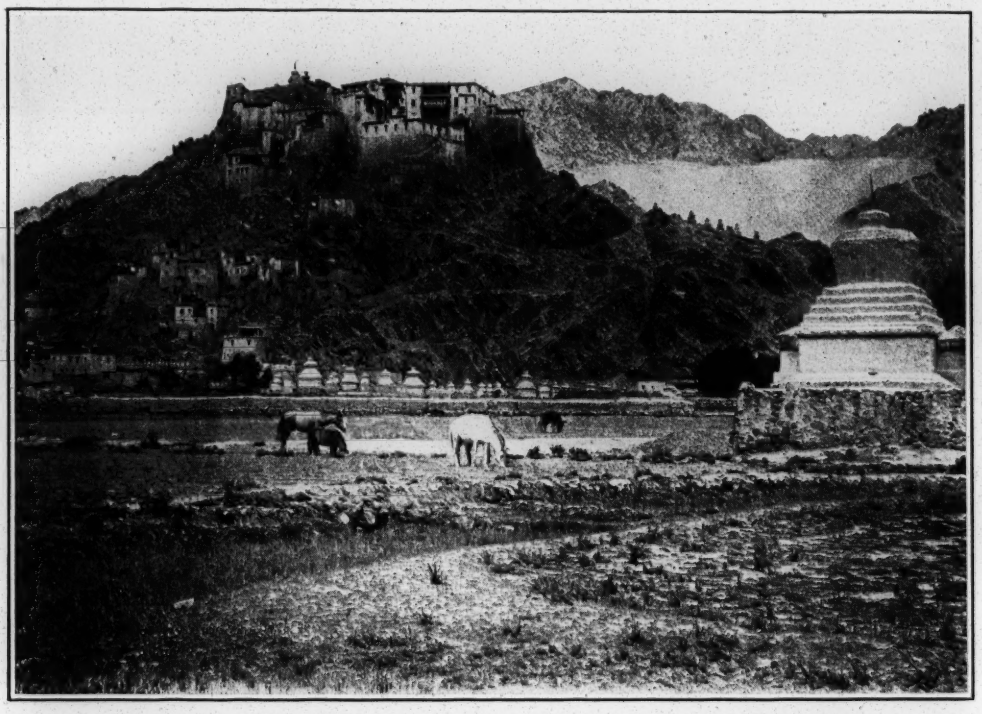
An Abandoned Monastery in Ladakh

Ladakh was originally a part of Tibet, then became independent, and in 1839 was annexed to Kashmir. The type of buildings is very similar to that of Lhasa



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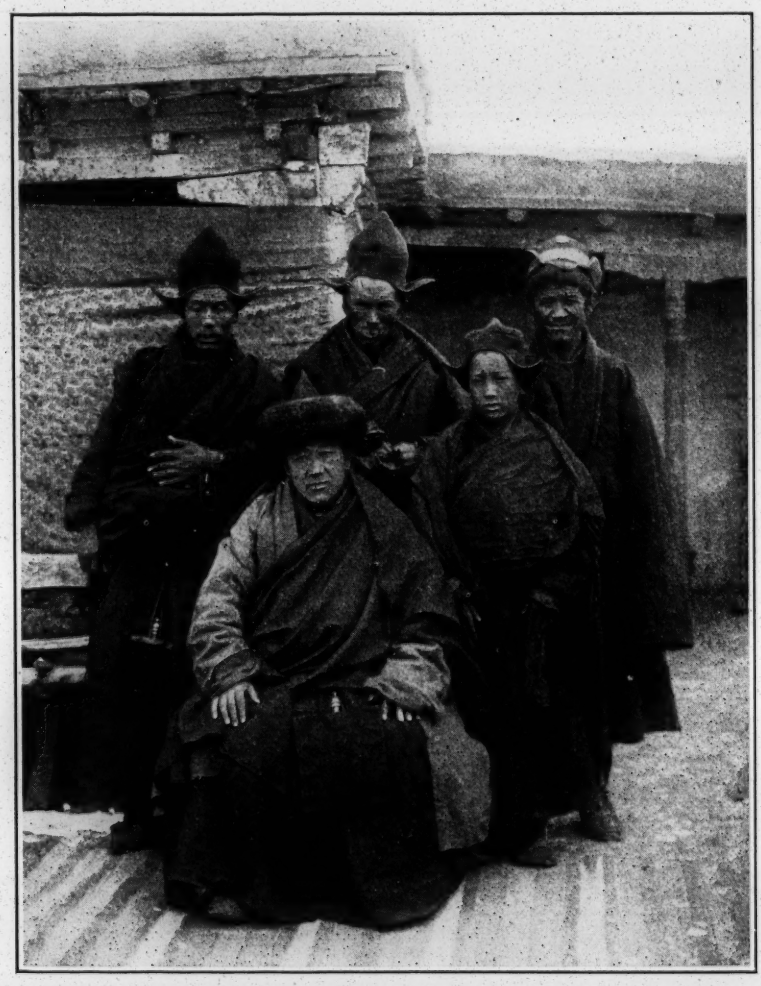
Another View of the Monastery at Ladakh

A massive native tombstone is seen in the right foreground and others at the base of the hill

THE CROSBY EXPEDITION TO TIBET

AT a recent meeting of the National Geographic Society Mr Oscar T. Crosby gave an interesting account of his journey through Chinese Turkestan and into Tibet in the fall of 1903. Mr Crosby left the railway at Andijan; thence he proceeded by caravan to Kashgar, Yarkand, Khotan, and Polu, which is situated at the foot of the Tibetan plateau. Here the real work he had planned—the ascent of the Kuenlun Mountains by an hitherto untraversed route—began. After much labor the party gained the plateau, but the zero temperature and biting winds at that height of 18,500 feet exhausted their horses and made their guides desert. Provisions failing, they called a halt and sent ahead for help. Fortunately, a party of wandering Kirghez met the messengers and conducted the whole party to the known country. They gained Ladakh, crossed the Himalayas, and struck the railway again. Speaking of the Tibetans, Mr Crosby said:

"We met with nothing but kindness wherever we went. The savagery and



Copyright, 1904, by O. T. Crosby

A Group of Lamas, Ladakh

hostility to strangers of the Tibetan people exist almost entirely in the imagination of novelists and unfriendly political writers. True, they do not desire the Western civilization and they resent the intrusion of white men in their domestic affairs. They are satisfied with their lot, and desire nothing better.

"The exclusiveness is more Chinese than Tibetan, for the Chinese exercise a wide influence in the country. They feel the incursion of foreigners into China has not been altogether happy in its results, and the tales the Chinese envoys and other representatives have told have alarmed the timid Tibetans and made them pitifully anxious to avoid the same fate.

"I have never felt there existed any real danger to England's sway in India

from a Russian descent across the Tibetan plateau; but it is not the Tibetan army, but its climatic and structural peculiarities, that would prevent it. My own experience has convinced me that no army of men unaccustomed to living in the high altitudes of the plateau could be maintained in that region. They could not live, and certainly they could not march on foot. The difficulties of transport are perfectly insuperable.

"As the expedition of Colonel Younghusband has demonstrated, it is much easier to get into Tibet from India than from Russia, and it has also shown what weak resistance the soldiers of the Grand Llama are able to offer any modern and well-disciplined force. Armed with matchlocks, swords and knives, and similar weapons of medieval warfare, they are as helpless as so many children with toy guns.

"Among the occasional travelers we met on the route were a Chinese merchant and his wife, both Mohammedans from Manchuria, and then engaged in making the holy pilgrimage to Mecca.

"They were mounted on the little mountain ponies, and had been already more than three months on their way. The end of their pilgrimage was at least five months ahead, but they were not discouraged, and went confidently and bravely on, the wife no less enthused than her husband, though she perhaps thought she was barred from the delights of Paradise, an entrance into which the man was to make certain by his pious zeal. We furnished them directions for their journey and all the help we could give—and they passed out of our sight across the snows."

Mr Crosby brought back some ancient manuscripts from the sand-buried ruins of Khotan. The manuscripts have not yet been deciphered, but they are pronounced exceedingly valuable. He has located the source of the Korakash River and obtained new information regarding the mountain chains forming the northwestern boundary of Tibet.

GEOGRAPHIC NOTES

IS THE NEW IMMIGRATION DANGEROUS TO THE COUNTRY

THAT the Italians, Poles, and Huns who are entering the country by the hundred thousand are a source of wealth and progress for the United States instead of becoming a burden and a danger, as so often argued, is the conclusion of Hon. O. P. Austin, expressed in an article in the *North American Review* for April. Since 1789, 22,000,000 immigrants have joined us, of whom ten and a half million are now living. Of this grand total 5,000,000 have come from Germany, 4,000,000 from Ireland, 2,750,000 from England, 2,000,000 from Canada, and 1,500,000 each from Italy, Austria-Hungary, Russia, Norway, and Sweden.

The latest statistics show that the so-called "objectionable" class, instead of leading in the number of criminals and paupers, gives the United States a much smaller proportion of disreputable characters. A comparison based upon the census of 1890, the latest available figures on crime and dependency, shows that per each million of the different foreign-born elements, there are in prisons and benevolent institutions, etc., of Poles, 4,580; Austrians, 4,805; Russians, 5,202; Germans, 5,662; Hungarians, 6,792; English, 7,160; Scotch, 7,288; Italians, 9,877; French, 10,864; Irish, 16,624.

Foreign born parents are more particular to send their children to school, and as a consequence the children of foreign born show a better percentage of literacy than the children of native born.

Though immigrants are coming in greater numbers, relatively to our total population they are fewer than they were some decades ago. The percentage of our foreign-born population is at present less than at any time during the last fifty years, with the exception of 1880. It is now 13.6, which shows that we can give them at least the same degree of assimilation.

The importance of this element as a factor in the development of the country and the creation of wealth is discussed at considerable length. The "objectionable" class are almost entirely located in those states which have the greatest *per capita* of created wealth, and study shows that they are a most important factor in the production of this wealth. Twelve states—New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, Ohio, Illinois, Iowa, Michigan, Wisconsin, Minnesota, and California—possess 81 per cent of the "objectionable" immigrants that have come to this country. These same states have received also 78 per cent of all the immigrants, and have nevertheless only one-half of the population of the United States. The foreign-born population of these twelve states averages 21 per cent, while the foreign population of the rest of the United States averages only 6 per cent. Notwithstanding the floods of immigrants of recent years, the *per capita* created wealth in these twelve states is $179.31, while in the others it averages only $119.98. Three-fifths of the nation's wealth are in these states.

The Bureau of Statistics is publishing a series of special reports from our consuls in Europe on the emigration from the various countries.

OUR PRESENT POPULATION

THE Census Bureau estimate of 79,900,389 for the population of the United States on June 1, 1903, seems conservative and is probably at least one million short of the actual number. The increase during the three years by this estimate is 3,905,814. Inasmuch as during the three years the rush of immigrants was enormous, reaching over 1,900,000, this estimate implies that our natural increase by excess of births over deaths has been only 2,000,000. This amounts to about .009 per cent natural increase per year. Our natural rate of increase for the decade 1890–1900 averaged nearly twice as much—.0157. If our natural increase has continued at this same rate—and there is little reason to believe it has appreciably diminished during the three years—we have had an excess of births over deaths of 3,572,000, which would make our total population on June 1, 1903, 81,472,000.

The Census Bureau will hereafter make annual estimates of our population based upon what is known as the arithmetical method.

"This rests upon the assumption that the annual increase for each year since the last census will be one-tenth of the decennial increase between the last two censuses. The country as a whole and most of the states and cities are growing with a steadily decreasing percentage of increase. As this condition has obtained in the United States for the last twenty years, it is likely to hold good in the immediate future. Under such conditions the arithmetical method has been proved more accurate than any alternative method."

PAN-AMERICAN RAILWAY

MORE than one-half of the all-rail route between New York and Buenos Ayres has been constructed, according to the report of Charles M.

Pepper, the Pan-American Railway Commissioner. The all-rail line will be 10,228 miles long if completed by the route selected and announced by the Intercontinental Railroad Commission in 1899, and it will cost $150,000,000 to construct the 4,800 miles now lacking. Mr Pepper's report is published as a Senate document, and gives many facts showing the present prosperity enjoyed by the majority of the South American republics. During the past five years 656 miles of the Pan-American route have been built, but without direct reference to the Intercontinental project. The Chilean government has contracted to pierce the Andes with a tunnel to connect with the Buenos Ayres line, so within several years cars will be running between Valparaiso and that city. Chile is also seriously considering building a railway parallel to her coast from Santiago to Iquique.

The Argentine Republic is extending her lines northward into Bolivia as far as Tupiza, by treaty with Bolivia. The Argentine system of railways, 11,360 miles in all, represents an investment of one-half billion of dollars, on which the roads netted 3.71 per cent last year. The Peruvian Congress has established a permanent railway guaranty fund of $1,000,000 annually out of the proceeds of the tobacco tax. Mexico is extending her lines southward; they will soon reach the Guatemalan border. In Central America, Guatemala and Costa Rica have each nearly completed the trunk lines which are to connect their Atlantic and Pacific coasts. Brazil has undertaken to build within four years a railroad from Santo Antonio around the Maderia Falls to the Mamore. The length will be about 300 miles. This railway line will insure the benefit of rail and water communication to the great region tributary to the Amazon. All these railways will be feeders of the great through line. The report contains a large map of the Intercontinental railway.

MAP OF THE UNITED STATES

MANY inquiries have been received by this Magazine for a good wall map of the United States. The most serviceable map is one published by the General Land Office, 5 x 7 feet. The map is in seven colors, is in considerable detail, and contains insert maps of Alaska, the Philippines, Hawaii, Samoa, Guam, Porto Rico, and Cuba. The map also shows the successive additions to our territory. It is backed with cloth and mounted on rollers, all ready to hang on the wall. The Land Office sells one map only to each applicant for 80 cents, the actual cost of printing and paper.

THE CARNEGIE INSTITUTION

THE Carnegie Institution has recently inaugurated two new lines of geographic work whose importance and value will be far reaching. Each work is outside the sphere of the national government, and each also has been too expensive to be undertaken by a private purse.

A large annual grant has been made for the exploration of the South Pacific islands and ocean floor, extending from the Galapagos Islands, west of Ecuador, to the Philippines. The work is under the charge of Alexander Agassiz and it is expected will require ten years for completion. It is undoubtedly the most important geographic enterprise undertaken by any nation for many years. The groups to be examined are Massason, the Society, the Paumotus, the Marquesas, the Cook, Samoa, Fiji, the Elice group, Marshall, and Carolines. The explorations will not be confined to land, but will include much deep-sea dredging between the archipelagos in order to obtain some idea of the contrast or affinities between the insular oceanic faunæ and the Pacific deep-water faunæ. It is imperative that the islands be studied at once, before their isolation is entirely gone and their individual characteristics modified.

A generous grant has been made to establish a "Department of International Research in Terrestrial Magnetism," to be under the direction of Dr L. A. Bauer. The magnetic storms that have swept around the globe so frequently of late, notably on the occasion of the eruption of Mont Pelée, and again in the fall of 1903, when the storm was so violent in the United States that telegraph communication was for a time interrupted, have excited much attention, but our knowledge of the earth's magnetism is so meager that the cause or origin of these storms can not be explained. Some of the problems which Dr Bauer hopes the new department will be able to investigate are: a magnetic survey of ocean areas and unexplored regions, international observations of the variations, observations in ocean depths and atmospheric regions, the correlation of magnetic and electric disturbances with meteorological phenomena, etc. Dr Bauer will continue at the head of the magnetic division of the U. S. Coast and Geodetic Survey.

TWENTY-FIFTH ANNIVERSARY OF THE U. S. GEOLOGICAL SURVEY

ABOUT one-third of the United States, 929,712 square miles in all, exclusive of Alaska, have been surveyed and mapped by the Geological Survey since its formation in 1879. The Survey is now sending out each year 260,000 volumes, 45,000 geologic folios, and 450,000 maps. It receives an annual appropriation from Congress of $1,500,000.

The detailed map of the United States which the Survey is making is the greatest topographic work in magnitude and detail ever attempted by any government. The earlier reconnaissance surveys were relatively inexpensive, the average cost varying from two to four dollars per square mile. The surveys executed between 1884 and 1890 varied in cost from three to seven dollars per square mile. The more accurate maps now made on the larger standard scale of 1 mile to 1 inch vary in cost between ten and twenty-five dollars per square mile, depending upon the character of the topography, the amount of settlement, of woods, etc.

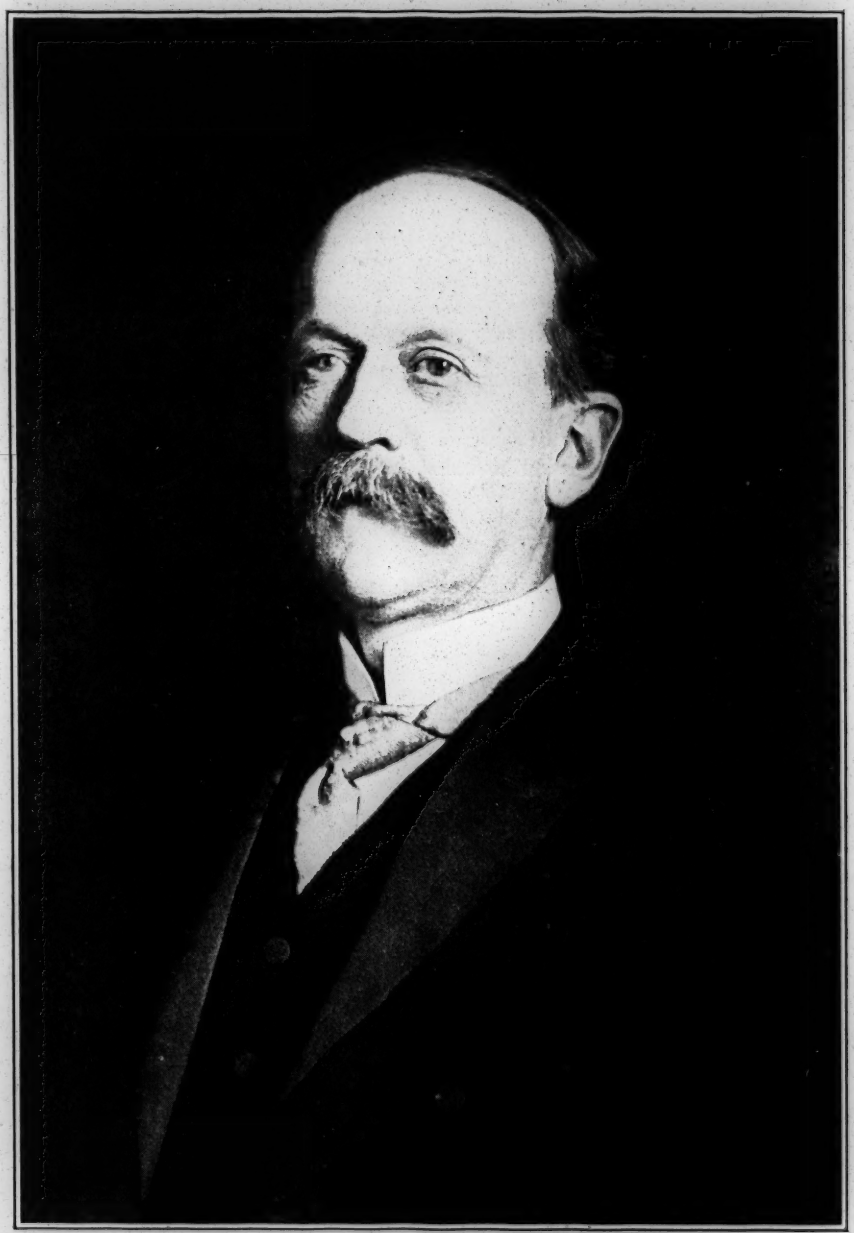
The mapping is, however, but a fraction of the Survey's present work. There are many other big tasks with which it is charged—the geologic survey of the United States; the exploration of Alaska; the reclamation of the West, involving the investment of over $20,000,000 of federal money in irrigation works; the examination and report on new gold, copper, coal, oil, and other mineral deposits, involving the investment of many millions of private capital, and the many branches of profound scientific research upon which most of the practical results depend.

On April 2 the Geological Survey celebrated the twenty-fifth anniversary of its formation by a dinner in Washington attended by over 300 members of the Survey. Col. H. C. Rizer acted as toastmaster. Speeches were made by Speaker Cannon, Secretary of the Interior Hitchcock, Director Charles D. Walcott, and Dr C. Willard Hayes.

Others who responded to toasts were G. K. Gilbert, "Scientific Work of the Survey;" S. F. Emmons, "Economic Work of the Survey;" Henry Gannett, "Topographic Work;" F. H. Newell, "Hydrographic Work;" J. F. Kemp, of the Columbia University, New York, "Geologists in Outlying Districts," and George Otis Smith, "The Younger Generation in the Survey."

SUMMER SCHOOL OF GEOGRAPHY AND GEOLOGY AT CORNELL UNIVERSITY

IN 1903 Cornell University started the original experiment of a summer school of geography, physiography, and geology, designed principally for teachers who might wish to combine field



Hon. Charles D. Walcott, Director of the U. S. Geological Survey since 1894 and Secretary of the Carnegie Institution

On April 2 the Geological Survey celebrated the twenty-fifth anniversity of its formation

and laboratory exercises with good lectures. The school proved a great success. Teachers came from seventeen different states, including superintendents, principals, normal-school teachers, teachers in the high schools and in every grade where geography is taught.

The University has wisely decided to continue the school during the summer of 1904. This year, as last, it will be conducted by Prof. Ralph S. Tarr, with an able corps of assistants—Professors A. P. Brigham, Charles A. McMurry, Philip Emerson, Frank Carney, Ray Hughes Whitbeck, George D. Hubbard, F. V. Emerson, and B. S. Butler.

A more instructive location from a geographical point of view could not be chosen than the site of Cornell University. Situated on a hillside overlooking a large lake in one direction and broad, beautifully sloping valleys in the other, and bounded by narrow gorges with many falls, cascades, and rapids, the campus is the center of a great variety of beautiful, interesting, and instructive geographic features.

The connection of the school with a large university gives it many advantages. The university library is fully supplied with books and magazines on geologic and geographic subjects, and these are accessible to the students in the school. The laboratories are equipped with many models, maps, photographs and specimens illustrating phases of geology, physiography, and geography. There is, furthermore, a collection of fully 5,000 lantern slides for use in the lecture courses, so that it is possible to bring into the class-room clear illustrations of almost every topic that needs illustration.

GIRDLING THE GLOBE

REAR ADMIRAL C. M. CHESTER sends this Magazine the following note written by Prof. Otto Klotz, of Ottawa, at Adelaide, Australia, concerning the latter's work in girdling the globe astronomically:

"The Dominion of Canada has undertaken, on her own initiative, and entirely at her own cost, the work of girdling the globe astronomically. This has been made possible by the completion of the Pacific cable. Canada has carried the work from Greenwich, which is the first meridian of the British world, across the Atlantic, across Canada to Vancouver, where it connects with the Pacific cable. From there it goes by Fanning Island to Fiji, to Norfolk Island, and then, at Southport, near Brisbane, to Australia. The work was thence continued to Sydney, where it joined the longitude carried from Greenwich eastward via Suez, Madras, and Singapore to Port Darwin, and thence to Adelaide, Melbourne, and Sydney.

"I also visited New Zealand, and tied that prosperous colony to the girdle, the cable connection being from Norfolk Island to Doubtless Bay, and thence by land lines to the observatory at Wellington.

"The result of the work in which I am now engaged is of special value to the whole of the Pacific, for the determination of the position of the islands. Furthermore, it will be of considerable scientific interest, and besides, being the 'all red' line, is a further link in binding the various parts of the British Empire together. Canada, I may say, takes special pride in undertaking the work, considered in its imperial aspect. She has not invited the assistance of other parts of the Empire, although the result of the work will be of even greater value, as to the Pacific islands, for instance, than to herself. She is carrying it out by herself, with the object of contributing to the general good."

For the map of Alaska that is published as a Supplement to this number the NATIONAL GEOGRAPHIC MAGAZINE is indebted to the U. S. Geological Survey and in particular to Alfred H. Brooks, Chief of the Alaskan Division, and S. J. Kübel, Chief of the Engraving and Printing Division. An interesting feature of the map is the small key in the upper right-hand corner, which shows what sections of the territory have been surveyed.

A Favorable Report on the feasibility of a canal connecting the waters of the Baltic and Black seas has been submitted to the Czar by W. von Ruckteschell, the engineer specially appointed

to examine the project for the Russian Government. M. von Ruckteschell says that a waterway large enough for vessels drawing 31.5 feet could be built for $180,000,000 between Riga and Cherson. Of actual canals only 66 miles to connect the western Dvina and Dnieper rivers will have to be excavated. The length of this interior waterway will be 1,468 miles. The Dvina is used for 330 miles and the Dnieper for 1,072 miles. Such a canal would permit warships to go from the Baltic to the Black seas in seven days, while vessels now require several weeks for the voyage via Gibraltar. An interesting description of the proposed waterway is given by Ethelbert Watts, Consul General to St Petersburg, in Daily Consular Reports, No. 1911, March 26.

GEOGRAPHIC LITERATURE

Greater Russia. By Wirt Gerrare. Illustrated. Pp. viii + 337. 6 x 9 inches. The Macmillan Company. New York: 1904. $3.00.

This volume, reprinted from the edition of 1902, makes an excellent supplement to Senator Beveridge's "The Russian Advance;" Mr Gerrare goes considerably more into detail in his descriptions of Siberian towns, life, and commerce.

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Early Western Travels, 1748-1846. By Reuben Gold Thwaites. Vol. I. Illustrated. Pp. 328. 6½ x 9½ inches. Cleveland, Ohio. Arthur H. Clark Company. 1904.

The first volume in this valuable series includes: The journals of Conrad Weiser in 1748, giving an account of the first official journey undertaken by the English colonists west of the Alleghenies; the journals of George Groghan (1750–1765), giving an epitome of the Indian history of the period; the journals of Capt. C. F. Post of two trips from Philadelphia to the Indians of the Ohio, and the journal of Capt. Thomas Morris, who accompanied General Bradstreet (1764) on the latter's expedition toward Detroit. Professor Thwaites and the Arthur H. Clark Company, publishers, are doing a great service in bringing to light these personal narratives of early American exploration.

From Paris to New York by Land. By Harry De Windt. With 2 maps and 90 illustrations. Pp. 310. 5½ x 9 inches. New York: F. Warne & Co. 1904. $3.00 *net*.

The 90 illustrations of this volume form the best part of it and are alone worth the price of the book. The narrative is superficial and becomes tiresome because of the monotony of "hunger and filth" which the author endured and which he is constantly describing. As the journey from Paris to New York by land has been accomplished by no one else, and as it required much pluck and perseverance, it is unfortunate that Mr De Windt has not given the world a more valuable record.

ARTICLES FROM APRIL MAGAZINES

The Great Siberian Railway, James W. Davidson, F. R. G. S. Century Magazine.

The Two Pacifics, Harold Bolce. Book-lovers' Magazine.

The Bahamas and the Caribbees, Amos Kidder Fiske. Chautauquan.

Russia's Civilizing Work in Asia, G. Frederick Wright. Review of Reviews.

Panama Commission and its Work, Walter Wellman. Review of Reviews.

Yellow-Pine Industry in the South, W. Watson Davis. Review of Reviews.

Industrial Future of Chile in Connection with the Panama Canal, G. Fred Collins. Engineering Magazine.

Coalfields of Crow's Nest Pass, British Columbia, E. Jacobs. Engineering Magazine.

Home Life of Our Birds, James Rollin Slonaker. The World To-day.

The Great River. IV. William Garrott Brown. The World To day.

Forestry Problems of the United States, B. E. Fernow. Pearson's Magazine.

Many interesting articles relating to the geography of the United States and of foreign countries are appearing in the "World's Fair Bulletin," published monthly in the interest of the Louisiana Purchase Exposition, at 317 N. Third street, St Louis.

From Harbin to Mukden, Col. De La Poer Beresford. Fortnightly Review.

Spain Yesterday and Today, L. Higgin. Fortnightly Review.

Whaling in Hudson Bay, P. T. McGrath. New England.

The Mexican Hacienda, Its Places and People, George F. Paul. New England.

The Homes of the World, Martin Craft. Outdoors.

Salmon Fishing in Western Newfoundland, L. F. Brown. Outdoors.

Rise of Modern Japan, Jihei Hashiguchi. World's Work.

Our Trade in the War Zone, O. P. Austin. World's Work.

Highest Railway in Europe (Thusis to St Moritz), Enrica Bignami. Cassier's.

Highest on Mt McKinley, R. L. Dunn. Outing.

Untraveled Russia, J. B. Thomas. Outing.

Through Inland Seas (Great Lakes), L. M. Sill. Harpers.

The Sicilian Highlands, William Sharp. Atlantic.

Present Situation in Persian Gulf, E. Cotes. Contemporary Review.

The Great West and Two Easts, H. E. Reed. North American.

Is the New Immigration Dangerous to the Country, O. P. Austin. North American.

The Caucasian in Brazil, T. C. Dawson. Popular Science Monthly.

The Air of Luray Caverns, G. L. Hunner. Popular Science Monthly.

The Atlantic River (Gulf Stream), J. Drake. Strand.

A Cruise Among the Cannibal Islands, A. H. Burgoyne. Pall Mall.

The Ascent of the North Palisades, J. N. Le Conte. Sierra Club Bulletin.

Variations of Sierra Glaciers, G. K. Gilbert. Do.

How Private Burns Climbed Mt Pinatúbo, N. F. McClure. Do.

The Hillside Farmer and the Forest, George Hansen. Do.

The Notable Mountaineering of the Sierra Club in 1903, E. T. Parsons. Do.

On the Trail with the Sierra Club, W. F. Badè. Do.

BOOKS RECEIVED

Japan Today. By James A. B. Scherer, Ph. D. Illustrated. Pp. 323. 5½ by 7½ inches. Philadelphia: J. B. Lippincott Company. 1904.

The Non-metallic Minerals; Their occurrence and uses. By George P. Merrill. Illustrated. Pp. xi + 407. 6 by 9 inches. New York: John Wiley & Sons. 1904. $4.00 *net.*

The Arapahoe Sun Dance: The ceremony of the Offerings Lodge. By George A. Dorsey. Pp. xii + 228. 6½ by 8½ inches. With 137 full-page plates. Chicago: Field Columbian Museum. Anthropological series. Publication 75. Volume IV. 1903.

Elementary Geography. By R. E. Dodge. Profusely illustrated. Pp. 230. 8 by 10 inches. Chicago: Rand, McNally Co. 1904. 75 cents.

Rocky Mountain Exploration. By R. G. Thwaites. With maps and illustrations. Pp. 276. 5½ by 7½ inches. New York: D. Appleton & Co. 1904. $1.25 *net.*

Voyages du Ch. Alex. Lesueur dans L'Amerique du Nord (1815–1817). By E. T. Hamy. Illustrated. Pp. 108. 9 by 11 inches. Paris: Au Siège de la Société des Américanistes. 1904.

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